MODERN WIRELESS

October

1/-

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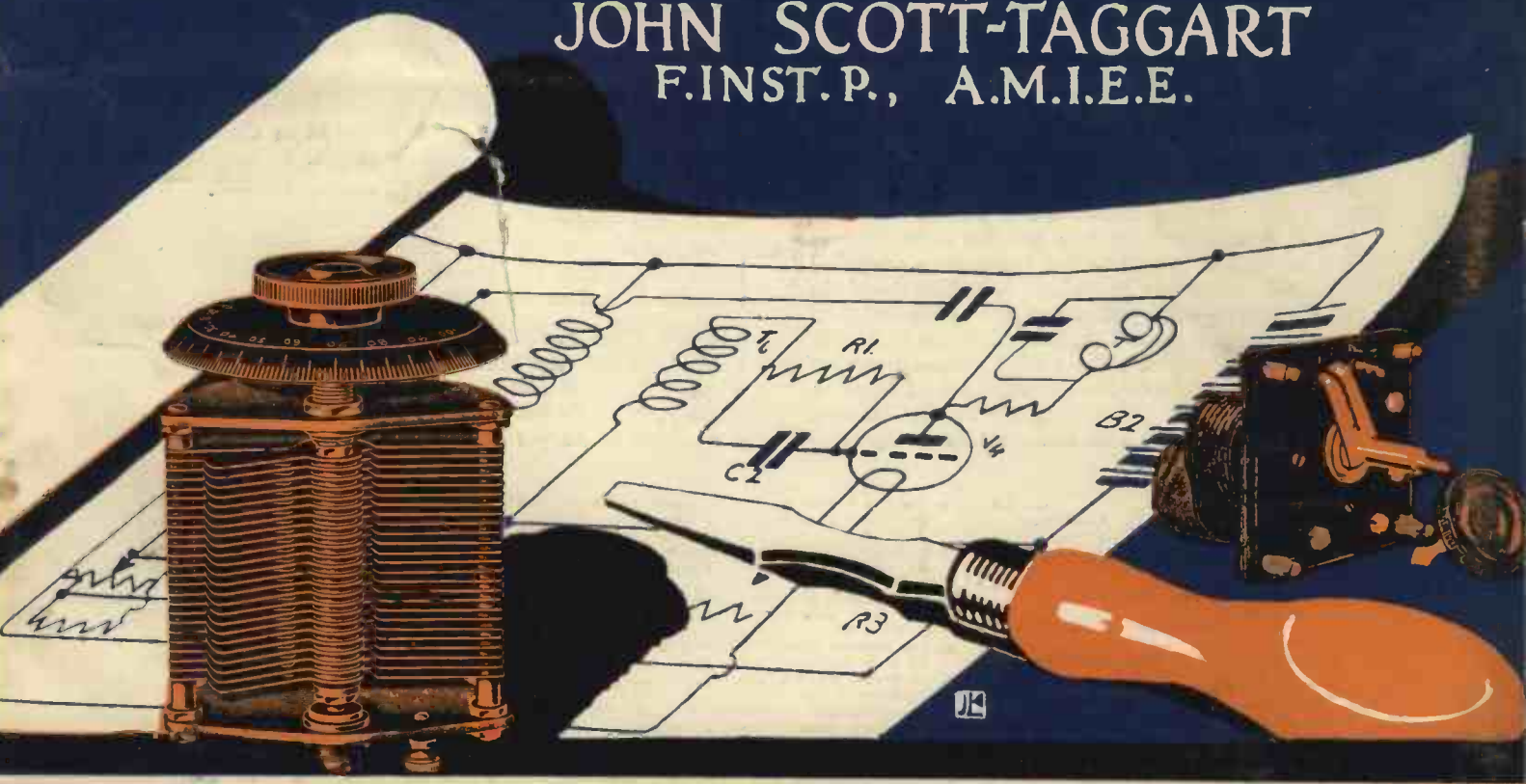
The Resistoflex Circuit

by

JOHN SCOTT-TAGGART

F.INST.P., A.M.I.E.E.



Vol. III.

No. 5

"I keep six honest serving men
(They taught me all I knew),
Their names are What and Why and When
And How and Where and Who."

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AND Radio Press can offer you, too, some honest serving men who will do their best to teach you some of the principles of Radio. The Library shown below contains some of the most entertaining and instructive Wireless Books ever published.

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RADIO COMMUNICATION COMPANY'S RESISTANCE CAPACITY COUPLING UNIT

THE PROBLEM.

Writing in Autumn "Radio" Mr. Ronald Ferguson declares:—

". . . . But having reached the limit of perfection in the province of the Broadcasting Company, less than half the work is done. What of the rest?"

and again

"Few people can be found in this country to-day who have not heard broadcasting, yet less than half of 1 per cent. of them have had an opportunity of listening to what, in the light of recent progress, can be called creditable reproduction."

PROGRESS.

Happily the problem is not insoluble. Mr. Norman Lea, B.Sc., A.M.I.E.E., the eminent Radio engineer, analyses it as follows:—

"Distortion in present day loud-speaker sets, and there is much of it, is due mainly to the use of iron core transformers. The human ear is sensitive to vibrations over a very wide range of frequencies, and, moreover, all these frequencies do, in fact, exist in the sounds which are broadcast. In order, therefore, that the loud-speaker may reproduce the sounds in a truly realistic manner, it is necessary for the electrical vibrations to be handed on from valve to valve in such a way that all frequencies are treated equally.

Individual human ears vary, of course, in regard to the highest and lowest frequencies which they can detect, but it is necessary to assume that all vibrations between frequency limits of 100 and 6,000 cycles per second are generally audible, and hence radio apparatus must behave rationally within the same limits.

It is impossible to expect iron core transformers to behave properly over such a large frequency range because of inductive effects, self capacity effects and eddy currents in the iron, all of which introduce different results with different frequencies.

Attempts have been made to design low frequency iron core transformers which shall have a constant performance with a variable frequency, but even the most successful commercial types fall far short of the ideal. It is, therefore, technically unsound to have an iron core inductively wound unit anywhere in a broadcast receiver, and distortionless reproduction cannot be obtained with apparatus so fitted."

THE SOLUTION.

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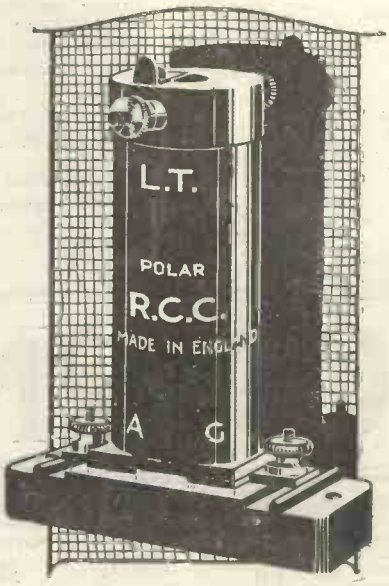

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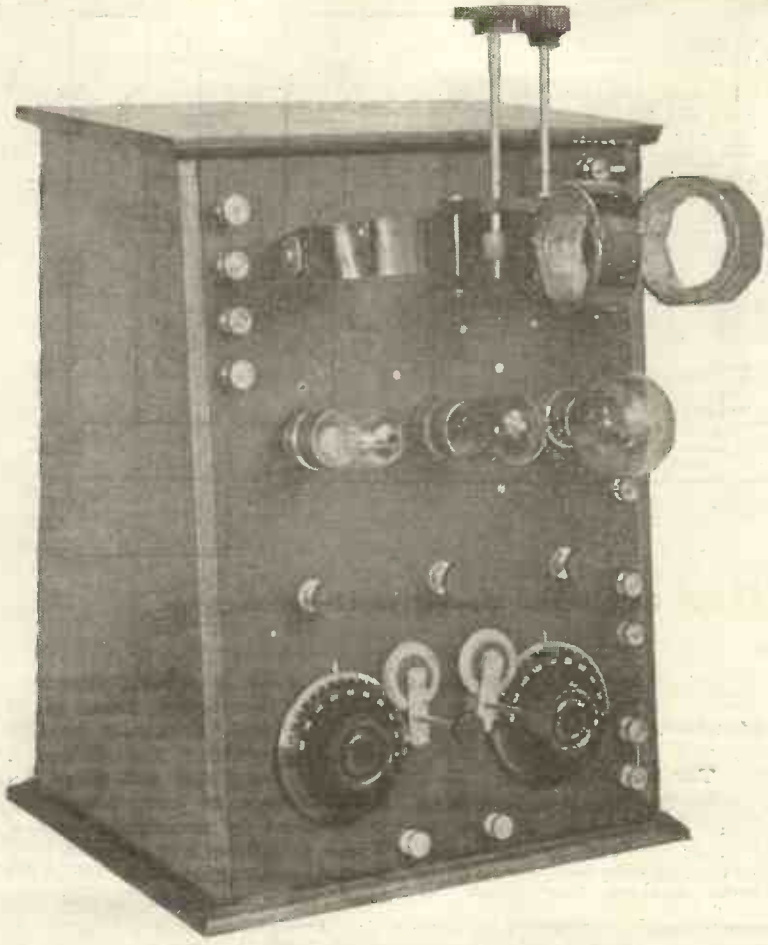


A Three-Valve Receiver

with Resistance Coupled Note Magnifier

By

HERBERT K. SIMPSON

An interesting modification of the well known S.T. 34 circuit.

Fig. 1.—The well-arranged layout and general appearance may be seen from the photograph.

FOR general reception, a very popular circuit is one which employs three valves, in the separate functions of high-frequency amplifier, rectifier and note-magnifier respectively.

The tuned anode method of high-frequency coupling is in extensive use at the present time, and when used with a direct coupled aerial circuit, is possibly the simplest way to connect up a high-frequency valve.

The note-magnifier may be either transformer or resistance-capacity coupled to the detector valve, the former method giving the louder signals, while the latter will give purer reproduction than any but the best kinds of transformer are capable of giving.

A receiving set following the lines indicated with resistance amplification is about to be described, and will be seen in the photograph, Fig. 1.

The aerial coil is plugged into the socket upon the panel, while the anode and reaction coils are mounted in a two-coil holder of conventional design. The two tuning condensers are mounted at the lower end of the panel, and vernier attachments have been provided to assist in the final stages of tuning.

Circuit Diagram

A diagram of the circuit arrangement is given in Fig. 2. It will be seen that the circuit is that which is known as S.T. 34, originally published in his book, "Thermionic Tubes," by Mr. John Scott-Taggart, the only alteration being the addition of one stage of resistance-capacity coupled note magnification. The aerial circuit is tuned by the inductance L_1 and condenser C_1, the small 0.0001 mfd. fixed condenser being used to introduce the constant aerial tuning system, if desired.

The incoming oscillations are impressed upon the grid of the valve V_1, which acts as a high-frequency amplifier, the amplified oscillations in the anode circuit being communicated to the grid of the valve V_2 *via* the condenser C_3, of 0.0003 mfd. capacity.

Reaction is obtained by coupling the coil L_3, in the anode circuit of the detector valve V_2, to the coil L_2, provision being made for the reversal of the connections to L_3 by means of two terminals X and Y, from which two flexible leads are taken to the movable socket on the two-way coil holder.

Constant Aerial Tuning

To use constant aerial tuning, with parallel variable condenser, join the aerial lead to terminal A, leaving A_1 free, connect C to E and to earth. The simple form of parallel tuning, without constant aerial tuning, may be used by joining the aerial lead to A_1, leaving A free, thus cutting out the small C.A.T. condenser. The earth is joined to E, as before, and C is linked to E by means of a piece of wire.

Series Tuning

For short wavelength reception it is advantageous to place the aerial tuning condenser in series with the inductance, and provision for this form of tuning has been made in this receiver. In this case the lead from the aerial is joined to terminal C, leaving both A and A_1 with no external con-

nection, and the earth lead is connected to E.

List of Parts Required

Those readers who intend to construct this receiver will find the following list of parts a help, and while it is not essential that the parts specified should be used, it is always advisable to use such parts as are or have been incorporated in MODERN WIRELESS sets, as these have been fully tested by those who use them, and readers may therefore rely on their efficiency. The parts required are as follows:

Ebonite panel, 14 in. by 10 in. by ¼ in. (Paragon. Peter Curtis Ltd.).
1 0.0005 mfd. variable condenser (Jackson Bros.).
1 0.0003 mfd. variable condenser (Jackson Bros.).
3 Lissenstat minor filament resistances (Lissen Ltd.).
3 Valve holders (H.T.C. Electrical Co. Type C).
1 2-way coil holder (Goswell Eng. Co. Vernier type).
1 coil plug for panel mounting.
2 "Fynetune" Micro-adjusters (Sparks Radio Supplies).
Fixed condensers (Dubilier, Ltd.).
1 0.0001 mfd.
1 0.0003 mfd.
2 0.002 mfd.
1 0.25 mfd. T.C.C. condenser.

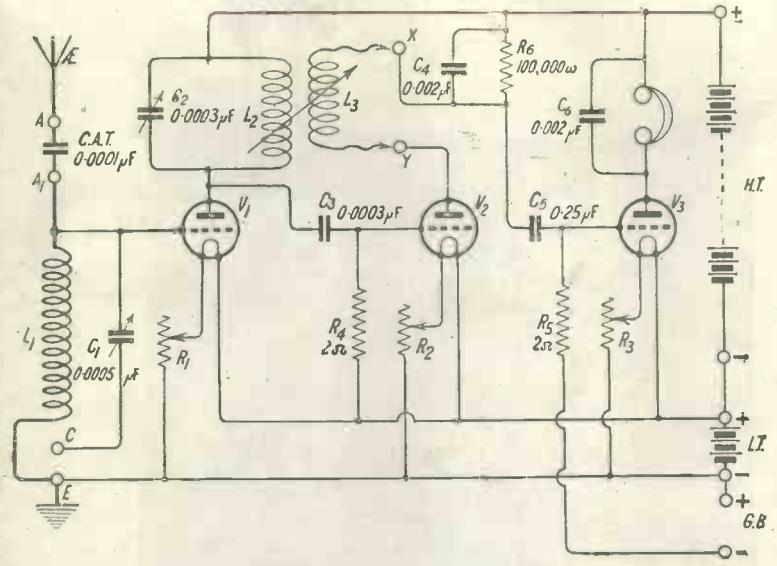


Fig. 2.—The theoretical circuit diagram.

1 Dubilier 100,000 ohm resistance.
2 Dubilier two megohm leaks.
14 terminals.

The Ebonite Panel

Remove the glossy surface from *unguaranteed* ebonite, if such is used. It is best to buy from reliable firms who guarantee their product.

Fig. 4 is a drilling diagram, sufficient dimensions being given to enable the constructor to drill his panel without any difficulty. Drilling templates are given by some makers, in cases where the holes must be accurately spaced. These templates are a great help to the constructor, and should be used when supplied. For the

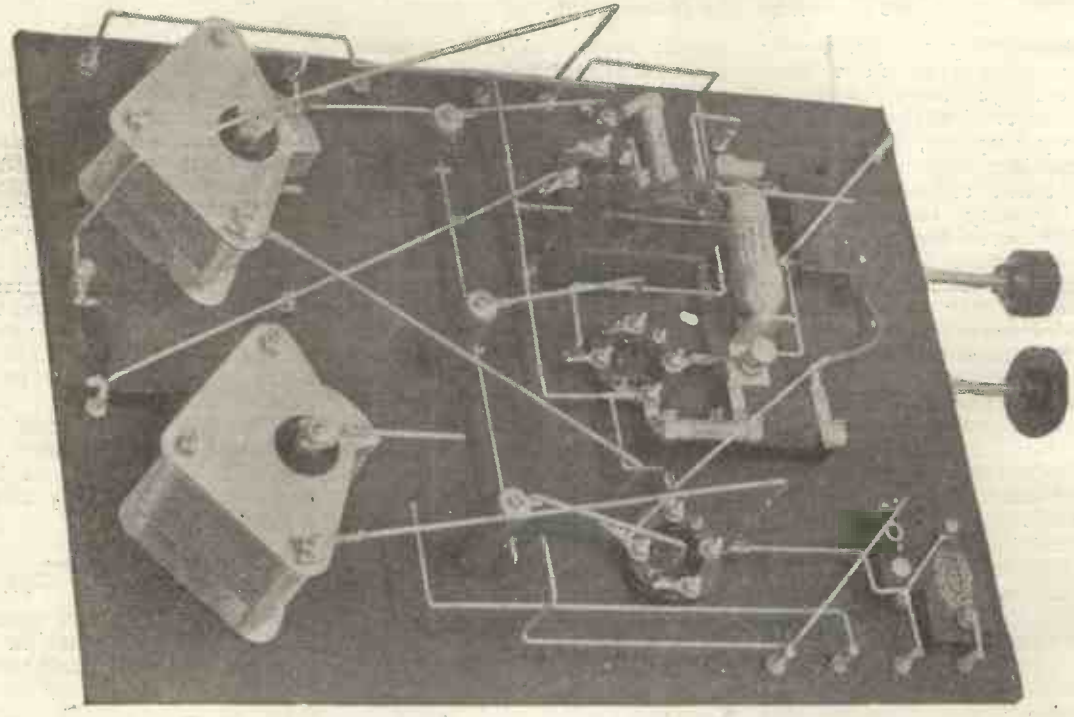


Fig. 3.—The simplicity of the wiring may be gathered from this photograph showing the panel removed.

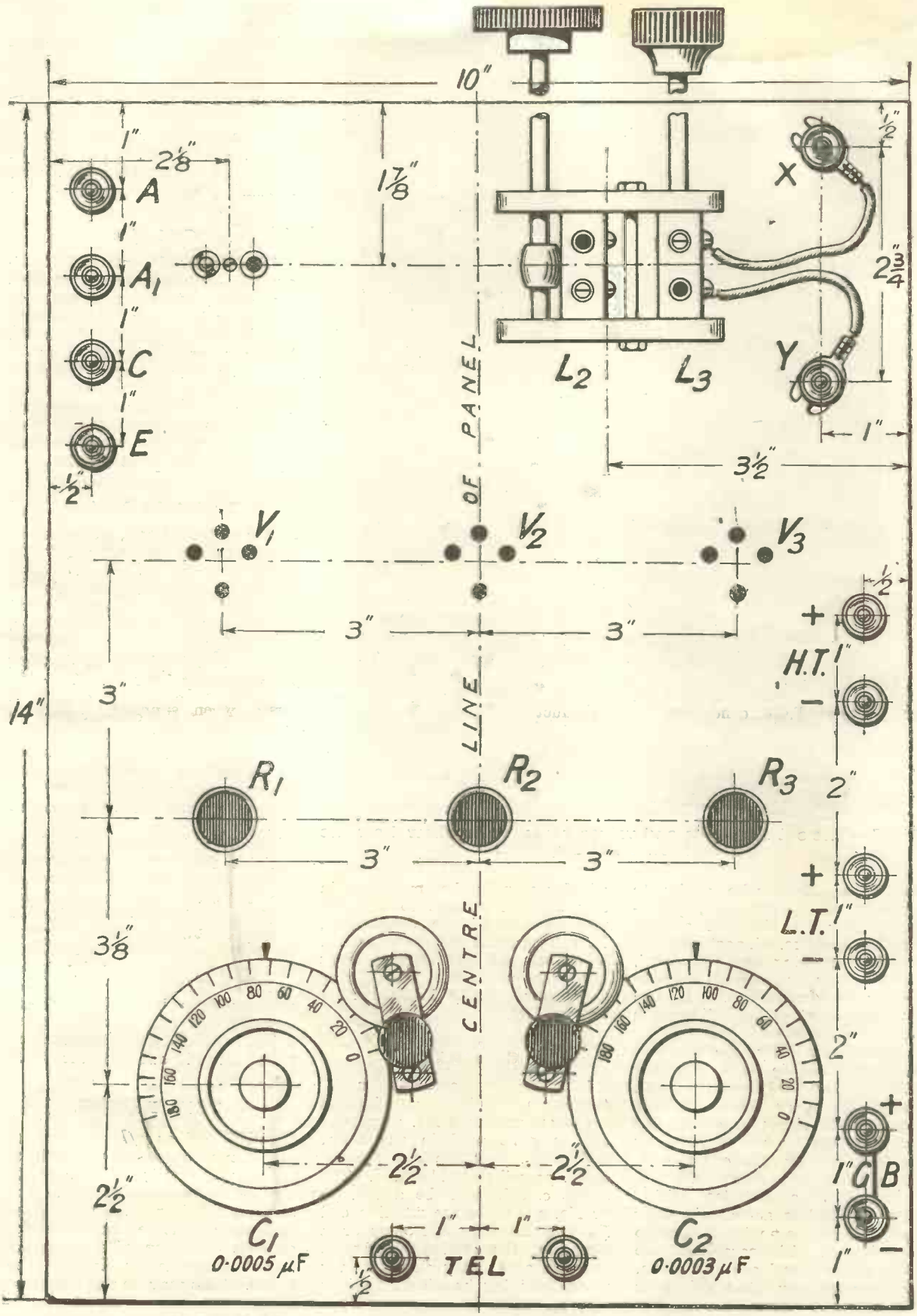


Fig. 4.—Drilling diagram showing front of panel. Blue Print 66A.

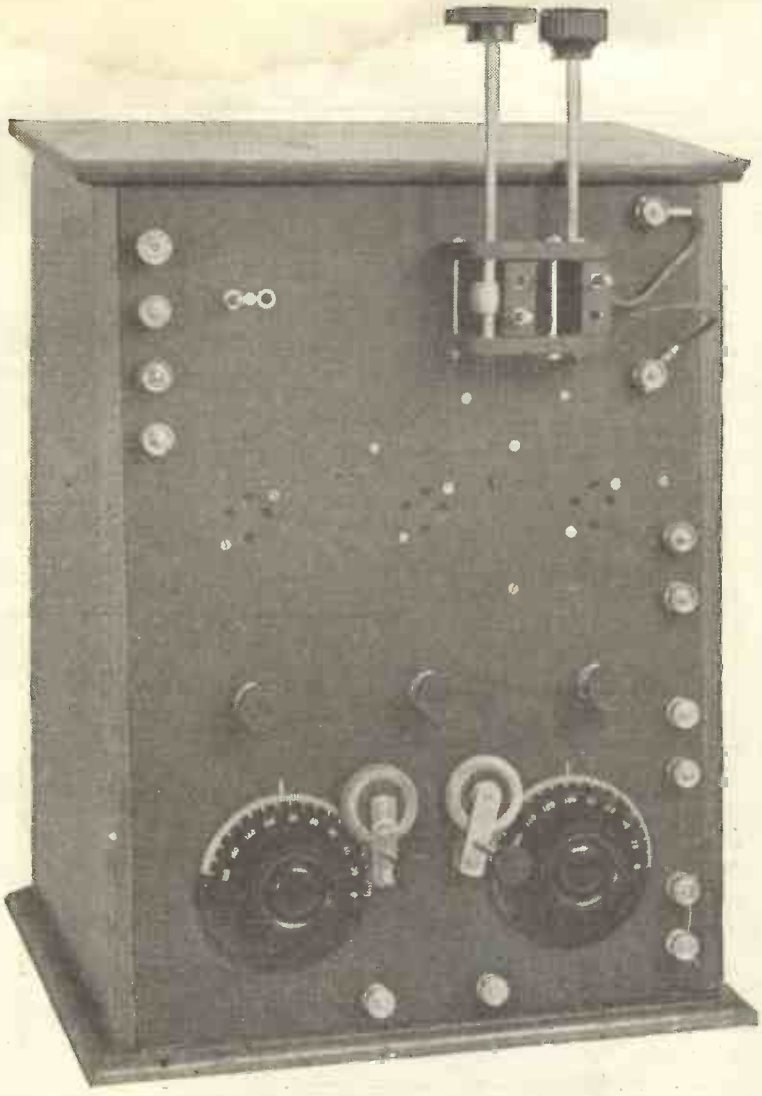


Fig. 5.—The set with coils and valves removed to show how the components are disposed.

benefit of those who prefer to work to full-size drawings, a blueprint may be obtained at the usual price of 1s. 6d. post free.

When marking out the panel, use a scriber, and scratch the lines lightly on the surface. If care is taken in placing the lines, the actual centre of each hole may be marked with only the shortest of lines, and in this case the marking may be done on the front of the panel, as the short lines marked will either be obliterated by the hole, when drilled, or covered up by the component, when the latter is mounted.

Fig. 6 is a detailed wiring diagram, and is sufficiently clear to enable even a novice to wire up his receiver. Photographs of the back of the panel are also given, to clear up any little points of difficulty which may arise.

The panel, when completely wired up, may be mounted in any type of cabinet to suit the requirements of the constructor. In the case of the receiver described, a cabinet of the sloping front type was used, the panel being only very slightly inclined from the vertical.

Coils to Use

When using constant aerial tuning on broadcast wavelengths up to 420 metres, a No. 50 plug-in coil may be used in the aerial socket L_1. Above 420 metres, a No. 75 coil should be tried. The anode coil L_2 will be a No. 50 or No. 75, while the reaction coil L_3 can be either a No. 75 or a No. 100, the alternative figures in each case being those to try when receiving broadcast stations above 420 metres, up to about 500 metres.

Continental Broadcasting and 5XX

For ordinary short wave Continental stations, the coils mentioned should be used. For reception of Radio-Paris and 5XX, the aerial coil L_1 will be a No. 150, while the anode and reaction coils are Nos. 250 and 300 respectively. For Eiffel Tower, the coils, in the same order, are Nos. 250, 400 and 500.

Grid Bias

Two terminals, marked GB+ and GB— respectively, are provided by means of which a negative bias may be applied to the grid of the note magnifying valve V_3. Whether or not grid bias is necessary depends upon the plate voltage and the valve used. Normally none may be necessary. If no grid bias is used, the terminals referred to must be joined together by means of a piece of wire.

Testing the Receiver

For an initial test, use constant aerial tuning, and try for the local short-wave station. Join aerial to A, earth to E, link C and E together. Having joined up the batteries and telephones, and inserted the valves and coils, turn on the filaments, keeping L_3 well away from L_2. Tune on C_1 and C_2 until the station is heard, when the coil L_3 may be brought slightly nearer to L_2, retuning on C_2. If this does not result in an increase of signal strength, the leads to L_3 should be reversed, and the procedure repeated.

Final adjustment of both variable condensers by means of the vernier adjusters will complete the tuning. The set may be made to oscillate by coupling L_3 closely to L_2, but this should not be done, excepting when receiving continuous wave telegraphy signals out of broadcasting hours. Distant stations may be picked up by coupling the coils so that the set is just not oscillating, and searching then carried out in the usual way.

TEST REPORT.

THE S.T. 34 with a stage of resistance note magnification was tested on Sept. 4, eight miles due east of 2LO. The aerial is a twin 70 ft., 45 ft. high at both ends, and the earth a heterogeneous collection of scrap metal buried immediately outside the house. This may be regarded as a fairly good aerial and earth system.

2LO was the first station to be

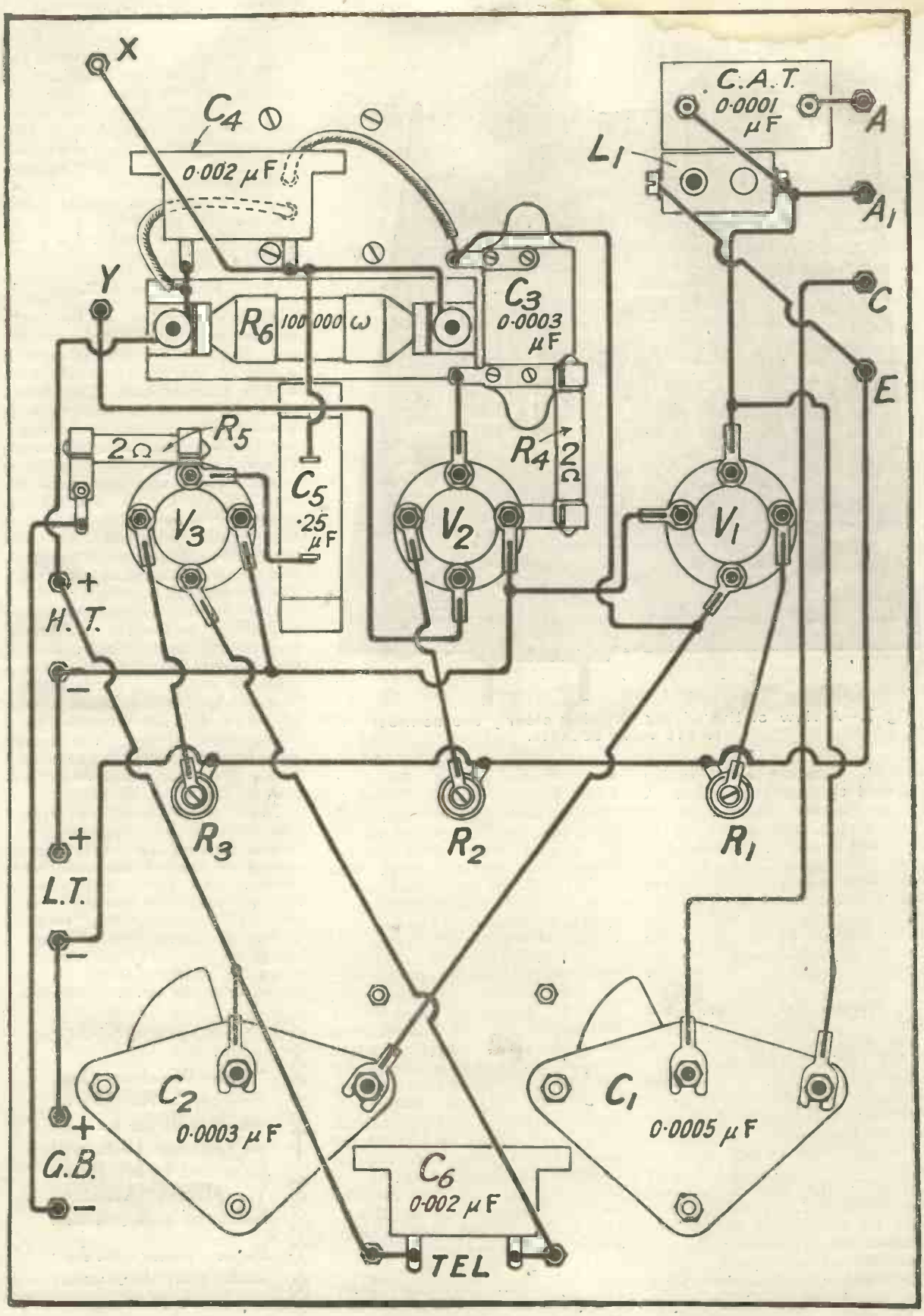


Fig. 6.—Back-of-panel wiring diagram. Blue Print No. 66B.

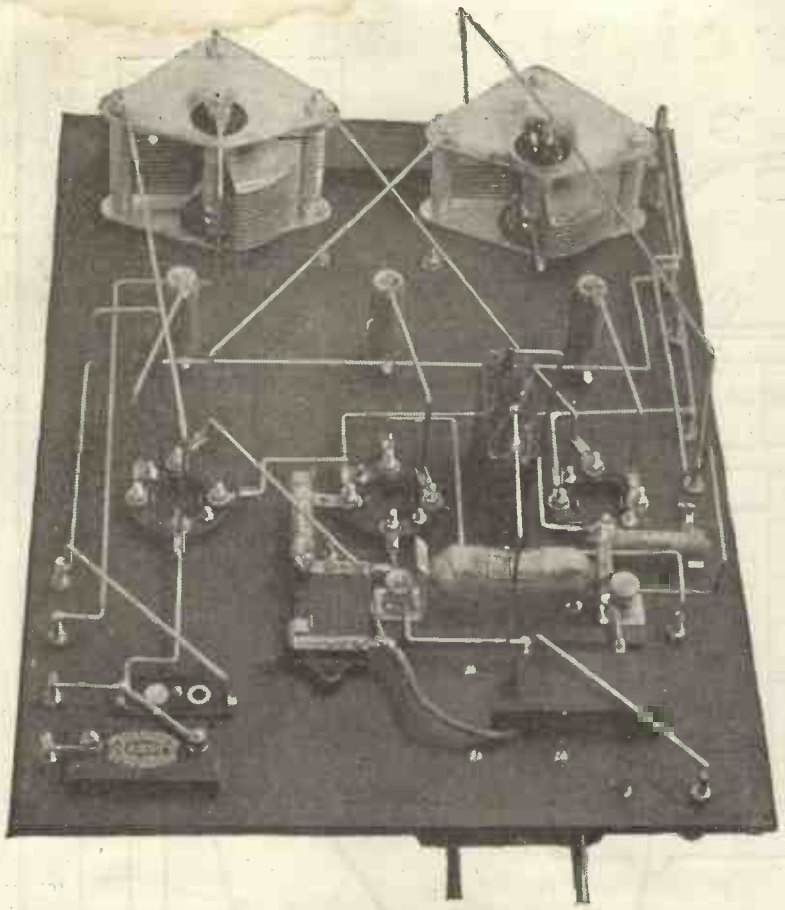


Fig. 7.—A view of the wiring showing clearly the connection to the valve sockets.

received. Constant aerial tuning was used throughout the test. A No. 50 coil was inserted in the aerial socket, and a No. 75 in the tuned anode. A reaction coil of 50 turns gave all the reaction that was necessary on this station, being coupled about 60 deg. from the anode coil. The aerial condenser was set at 49 deg., while that of the tuned anode was set at 25 deg. Approximately 60 volts H.T. was used. Full loud-speaking was obtained, and very pure and clear.

The next station obtained was Cardiff (5WA). This station required only 44 deg. of the aerial condenser, and the tuned anode condenser 20 deg. The same coils were used as above, the reaction coil being about 45 deg. coupled. At first this station was only just audible in the 'phones, but on lowering the H.T. to 45 volts, speech could be easily read and music obtained without forcing the reaction beyond safe limits.

London having closed down for a time, Manchester (2ZY) was tuned in by means of a buzzer wavemeter, but no intelligible speech was obtained (the carrier being fairly well in evidence when reaction was tightly coupled) other than just the recognising of the call sign and a few words here and there. This station tuned, with C.A.T. and the same coils as the two previous stations, with the aerial condenser set at 62 deg. and the anode condenser at 34 deg.

Bournemouth was obtained easily without the wavemeter with the same coils as previously—*i.e.*, 50 aerial socket, 75 tuned anode, and 50 reaction. This station came in with good 'phone strength (audible on the loud-speaker about 6 ft.), with the aerial condenser set at 72 deg., and the anode condenser at 36 deg. Bournemouth could not be received without the use of a wave trap when London came on shortly afterwards.

Birmingham (5IT) was received on the 'phones, with C.A.T. and a No. 75 coil in the aerial socket, and a 75 in the anode socket with a 100 in the reaction, the condenser readings being 42 deg. on the aerial condenser and 124 deg. on the tuned anode condenser.

Aberdeen was also tuned in with the same coils as above, but with the aerial condenser set at 58 deg. and the tuned anode condenser at 168 deg. The anode coil was then changed to a 100, which changed the anode condenser reading to 22 deg. This station, although being the most distant of B.B.C., was received so that it was audible on the loud-speaker at about 20 ft., sufficient for a small room.

Results on 5XX.

5XX was received on the loud-speaker with considerable volume with a 150 coil in the aerial socket, a 200 in the anode socket and a 250 reaction coil. The aerial condenser was set at 104 deg. and the anode condenser at 80 deg., the reaction being coupled about 45 deg.

Radio-Paris was also received with the same coils, but it was impossible to get rid of 5XX, the best results being obtained with the aerial condenser set at 160 deg. and the anode condenser at 110 deg. The reaction coil was merely tightly coupled to obtain maximum selectivity owing to London interfering. Radio-Paris could be heard in the loud-speaker about 20ft. away when 5XX was silent for a few moments. The aerial coil was changed to one of 200 turns, when the aerial condenser read 70 deg. The anode coil was also changed to one of 250 turns, when the anode condenser read 24 deg.

The French Postes et Télégraphes was also received at very good 'phone strength. At the time a lecture in English was being delivered. The aerial coil was a No. 50, while its condenser was set at 98 deg. and the anode coil a No. 75, and its condenser reading at 80 deg. The reaction coil was a No. 75, being coupled about 20 deg. from the tuned anode coil.

In passing

Trying

I WAS enduring one of those visits which periodically Poddleby pays to my wireless den. I say "enduring" because the experience is usually rather a trying one in that as he wanders round inspecting various gadgets, devices and bits and pieces, quantities of which decorate every part of the room from the mantelpiece to the coal-scuttle, he may light upon something which he will claim to be his own property. This always starts an argument and I detest that kind of thing. The worst of Poddleby is that he has not yet fully grasped what as I have so frequently pointed out is the real spirit of wireless. You don't own things purely for the pleasure of possessing them. No, ownership means far more than this. It means that you can always come to the help of such friends as are less well provided than you are with the things necessary for constructing those wondrous circuits which seldom work but never fail to give you pleasure and excitement when you make them up. I have done my best to instil proper feeling in this respect into Poddleby but so far without any really marked success.

Poddleby's Brain Wave

During the visit of which I am telling you, however, no contretemps of this kind occurred, for though he wandered about the room and fingered things as he usually does, it was obvious that Poddleby was pre-occupied. I suspected somehow that he was about to give birth to an idea. I therefore waited in silence until such time as he should be ready to get it off his chest. At length he cleared his throat, swung round on his heels to face me and said

"I have been thinking."

"I know, I know, Poddleby," I said; "for the last five minutes I have been watching what appears to be a singularly painful process. Really my dear old chap you must be careful, for after a heavy meal, and I am sure you did yourself extremely well at dinner, unwonted exercise whether physical or mental is dangerous. Still as you have been rash enough to indulge in thought it would perhaps be better for you to open the flood gates of speech. In other words what's it all about?" "If," said Poddleby, with a shrug of the shoulders, "you can refrain from making silly remarks for a moment and will allow me to get a word in edgeways I will tell you." This, reader, was Poddleby's idea.

I am Co-opted

I gathered from Poddleby's introductory remarks that there was something altogether wrong with wireless men as a whole and especially with those who inhabit Little Puddleton. I was just going to point out that I had been telling him that for years when he silenced me with a petrifying look. What was apparently worrying him was that we do not really make nearly such large portions of our sets as we ought to. He admitted that valves and gridleaks were best left alone by the amateur, but he explained that there were several quite simple components which nobody ever thought of constructing,

though everyone should most certainly do so. The accumulator and the high tension battery were amongst these, and he proposed to demonstrate to the club that it was perfectly possible for any really keen wireless man to turn these things out for himself. He announced that as he had had no real holiday for a month he was about to take a long week-end from the Friday until the following Thursday evening, which time he would devote to the construction of a genuinely home-made secondary battery for filament heating purposes. What he wanted to know was whether he could rely upon my help in his labours.

Operations Begin

Friday morning saw us both hard at it in Poddleby's workshop. The first thing to do, so Poddleby said, was to cast the plates. I was all for getting a disused set from the garage to save trouble, but Poddleby pointed out that this would not do at all since he intended to make every single bit of the accumulator. The plates, he explained, were to be cast in suitable moulds. If I would kindly go out with a bucket and a spade and bring in a suitable supply of clay he would busy himslf during my absence in making patterns. Now Little Puddleton stands, as house agents will inform you should you think of purchasing a desirable residence there, upon gravel soil. Other portions of our country may be composed of mere common clay, but Little Puddleton is not. I had heard though that Bilgewater Magna was on clay soil and for this reason I took the motor bus over there, conveying the spade and bucket with me. Several members of the club whom I passed on my way to the Town Hall where the bus stops inquired if I was off to the seaside and made other unmannerly remarks of which I am glad to say I took no notice. I reached Bilgewater Magna at one

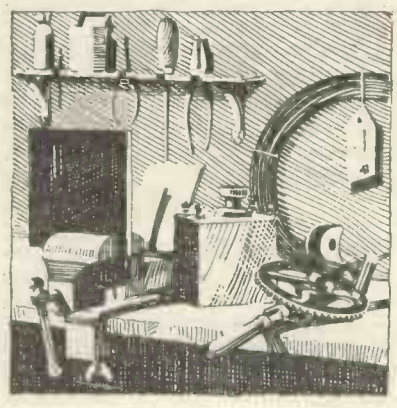
o'clock and as the inner man was crying aloud for sustenance after my drive I repaired forthwith to the local hostelry for lunch. After the meal the dread symptoms of my sad physical condition made themselves manifest and though I made a heroic fight against their onslaught it was not until five o'clock that I had sufficiently shaken off their effects to be able to rise from the armchair in the parlour to whose embrace they had driven me. There was a bus back at 5.10, so I dashed round to the local grocer, purchased half-a-dozen slabs of floor clay and put them in my bucket. On reaching Little Puddleton I added water to them and messed them about into a sticky mush which I felt sure would satisfy even the requirements of so exacting a person as Poddleby.

Gratitude ?

You would think that after labouring in this way, after struggling so heroically against the distressing symptoms produced by overwork and after returning with such a splendid specimen of clay, I would have received Poddleby's grateful thanks. But did I ? I did not. Even when I described my pilgrimage in search of clay through the sodden fields round Bilgewater Magna, when I told him that I had been chivvied by farmers, laughed at by rustics, chased by mad bulls and nearly arrested for land-grabbing, the man merely grunted. I added further adventures in the hope of arousing his sympathy but he simply listened with a nasty smile on his face. When I had quite finished and was gasping for breath he just pointed to my boots and said that all things considered I had kept them wonderfully clean. I had not thought of that, but it just shows how careful you have to be in dealing with such nasty and uncharitable creatures as Poddleby. It was now too late to do more until the following morning and I examined with considerable interest the patterns which Poddleby had produced during my absence. Though mine is the most generous of natures I found it difficult to congratulate him upon these without doing violence to my innate love of truthfulness. In his early attempts he appeared to have used up enough wood to build a house of respectable size. All kinds of weird productions were lying about all split or shattered in various ways. The final pair appeared to contain very few holes for the paste and what there were were not exactly square or arranged in any particular kind of order. However, even if his results were not first rate, Poddleby had undoubtedly shown commendable industry.

Casting the Plates

We resolved on the following day to make a trial attempt with Poddleby's patterns. He had contrived some moulds into which he puddled my clay. He then black leaded his patterns and made suitable impressions with them. We found that we had very little lead available but we managed to get quite a good supply from the scullery roof. Poddleby pointed out that as we had had so much rain during the summer there could not be much more to come, and anyhow one always associates sculleries with a plentiful supply of water. After overcoming stout opposition on the part of the cook Poddleby placed some of the lead in a ladle and melted it over the kitchen fire.



" Are you all ready ? " he shouted through the kitchen window. "Yes, come on," I yelled back from the workshop. Poddleby seized the ladle from the fire, dashed out of the door and sprinted down the garden with it in order to arrive at the mould before it had cooled. I think that he would have done so if it had not been for Poddleby Junior's hoop which, bowling merrily up the path, met him in full flight. As it was, he tobogganed for about five yards chiefly on his face (I think I have mentioned that Little Puddleton is situated upon gravel soil) and the lead fell in a shower which appeared to be far from refreshing upon the bed of begonias which is, or rather was, the apple of his wife's eye. When Poddleby had picked himself up and had delivered a little talk on the subject of small boys' hoops, gravel paths, unsympathetic friends and silly grins, he retired indoors to repair the damage. Meantime I returned to the scullery roof, for I thought it was up to me to see that there was at any rate no shortage in the supply of lead. With the aid of a pair of tin shears I cut out some quite respectable plates in which I drilled a multitude of holes. On Poddleby's reappearance some time later I showed him my idea for making plates and we decided that though the products were not perhaps so finished looking as plates cast by Poddleby's method might have been, the process was certainly less fraught with peril and should therefore be adopted.

Nearing Completion

Dozens and dozens of plates we turned out in this way, I doing the donkey work with shears and drill whilst Poddleby undertook the rather messy job of filling them with paste. This process completed, the case had to be made, a perfectly simple business when you know how to do it. All that you require is some stout celluloid and some stuff whose name I have forgotten though it smells like a Sunday school treat. We made a beautiful case between us and placed our plates in position. The next step was to prepare the electrolyte. This was Poddleby's pidgin and he proceeded in his best didactic manner to show me exactly how it should be done. As we had now reached the Thursday night the mixing of the electrolyte took place in Poddleby's wireless room where the light was better. On the table he placed a large china basin borrowed from the spare bedroom, a jug of distilled water and a bottle of sulphuric acid. " There is one little tip," he said, " that you have always got to remember in doing this. On no account must you add the acid to the water." " Isn't it the other way round ? " I said. " I don't know whether you are trying to be funny or merely showing your ignorance," was his reply. " If you will kindly watch me without indulging in ill-timed pleasantries you will see exactly how the thing should be done." Into the basin he poured a quantity of the acid and was just reaching for the jug when I reached the door explaining that I had left my pipe in the workshop and would be back in a moment. When I got back Poddleby's den looked rather as if it had been struck by a typhoon. Mrs. Poddleby was asking wildly what had exploded, and Poddleby, if you will believe me, was telling her that it was entirely my fault.

A successful Resistoflex set.

The Resistoflex Circuit.

A New Development in Reflex Circuits.

By
JOHN SCOTT-TAGGART
F.Inst.P., A.M.I.E.E.

A new and successful method of reflex working is disclosed in this article, and represents three years, work to produce an effective non-buzzing reflex set using a valve detector.

REFLEX circuits have undoubtedly captured the imagination of experimenters and constructors in spite of the fact that there are still certain factors which have prevented as consistent and efficient results being obtained as in the case of the ordinary straight circuit.

The reflex circuit is undoubtedly ideal, from many points of view, for the constructor who is limited to one or two valves. The experimenter with three valves is not so much concerned with the saving of the additional valve, for this is the one and only merit of a reflex circuit. On multi-valve sets I am very much in doubt whether the saving of an extra valve is worth bothering about, and the added complication is an important factor to be considered.

As Captain Round has pointed out, the really fundamental difficulty with regard to reflex circuits is the low-frequency buzzing due to the low-frequency currents modulating high-frequency oscillation, a peculiar chain of low-frequency reaction being set up. This, as has been pointed out in detail in these pages, is due to distortion in the dual valve due to a defective characteristic curve or improper adjustment of grid potential, anode voltage and filament current. Irregularities in these respects will cause the low-frequency currents which are fed back into the grid circuit of the dual valve to modulate oscillations set up, for example, by the dual valve itself when using reaction. This form of buzzing is merely one of the many which it is possible to obtain in a reflex set, and it is the most difficult to eliminate. A suitable adjustment of anode voltage, filament current, and grid bias will do a lot to prevent this form of buzzing, as also will the choice of a suitable valve. It is a good plan, in all dual circuits, to try different valves, if they are available, in the place of the one acting as the dual amplifier.

Having investigated very closely all the different methods of eradicating the causes of buzzing, I came to the conclusion that the one outstanding trouble was the

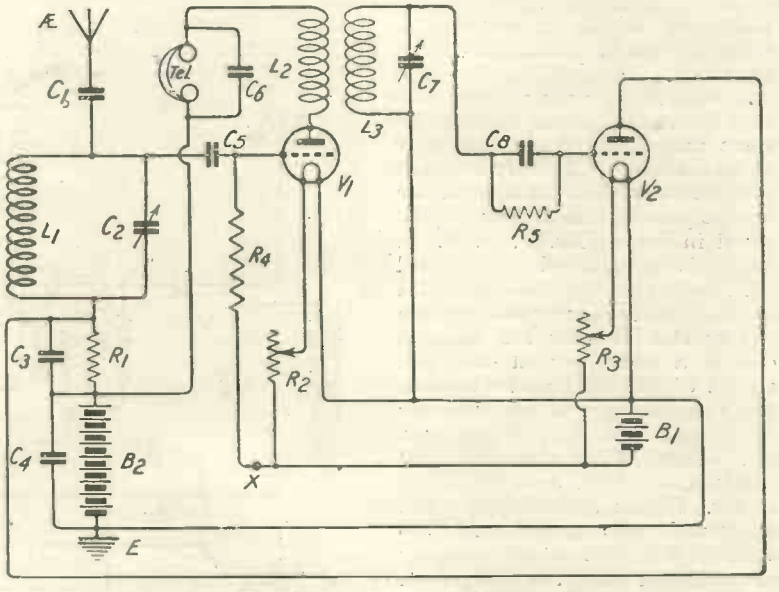


Fig. 1. An H.F. transformer coupled resistoflex.

fundamental one just described, and that the best way towards the solution of the problem was to cut out low-frequency resonating circuits in connection with the dual valve. The cutting out of any low-frequency transformers or telephones should make a very great difference indeed to buzzing tendencies. Most forms of buzzing

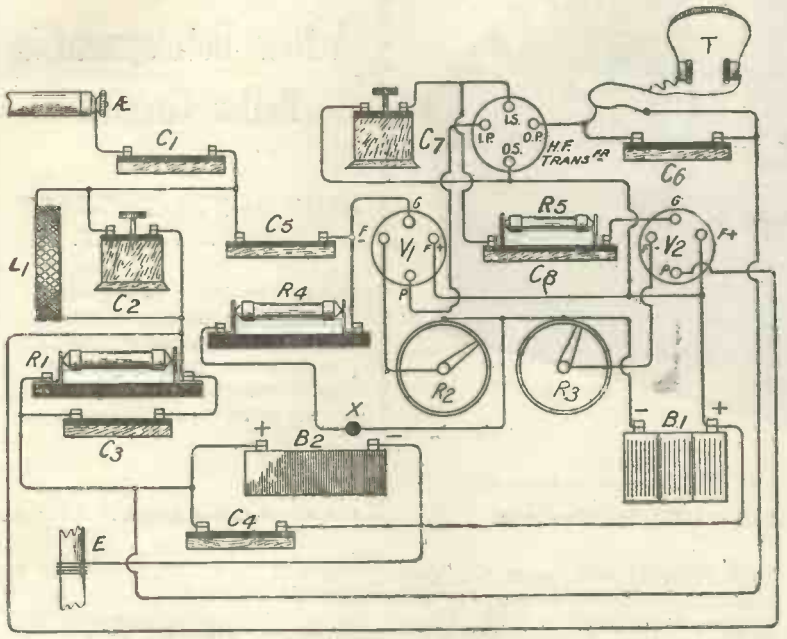


Fig. 2.—Pictorial form of Fig. 1.

are due to low-frequency oscillations being set up, these being dependent, in pitch, upon the constants of the iron-core transformers used to feed-back the low-frequency currents. This may be tested out by connecting different sizes of condensers across the secondary of the transformer, a varying pitch of note usually being produced.

Several months ago a patent was filed for arrangements which overcame many of the disadvantages of dual circuits. I desire to make it quite clear that cutting out the low-frequency transformer is not novel in itself. Mr. P. G. A. H. Voigt is prominently associated with the type of crystal-dual circuit in which the rectified currents from the crystal detector are used to charge a condenser in the grid circuit of the dual valve without the intermediary of an iron-core transformer. In July of this year, Mr. Percy W Harris, in these columns, described a development of Mr. Voigt's arrangements and using resistance coupling for the addition of a stage of low-frequency amplification after the first valve.

In May of this year I appreciated the importance of trying to cut out low-frequency resonating circuits in connection with the dual valve, and directed my attentions particularly to that biggest of all problems, the application of the dual principle to a valve receiver using a detector valve. I do not suggest that it is impracticable to use a transformer in, say, a two-valve dual circuit in which the second valve acts as a detector, but I do say that the difficulties are very much greater than in the case of a crystal reflex set. The impedance of the crystal has an undoubted influence on the stability of dual circuits. The raising of the cat's-whisker on the S.T. 100 is usually accompanied by a violent howl, ample indication of the damping effect of a crystal detector. On the other hand, there is undoubtedly a demand for a reflex circuit not using a crystal detector, and during the last three years I have been trying to evolve an arrangement which would be sufficiently reproduceable for general home construction. Readers are, no doubt, aware that there are several sets on the market manufactured by commercial companies using the reflex principle with a detector valve, but many stabilising devices are usually required to do this, and I very much doubt whether the arrangements are suitable for home construction by the wireless public.

An example of a circuit of this kind is the three-valve dual, which has given remarkable results where the original specification was closely adhered to. Unfortunately, it appears to suffer from the disadvantage that even small modifications may result in disappointing results.

The present circuit is the result of much experimental work in the direction of producing a reflex circuit using a valve as a detector and eliminating a low-frequency resonant circuit. Although disapproving in principle to extending the wireless vocabulary by unnecessary names for circuits, yet in certain cases it is extremely convenient for those of us connected with the Press to evolve an easily remembered name which may be used in correspondence and articles as a convenient method of identifying a certain circuit or principle. The word "Resistoflex" has, for the sake of convenience, been given to the class of circuit about to be described.

The general principle is, like many

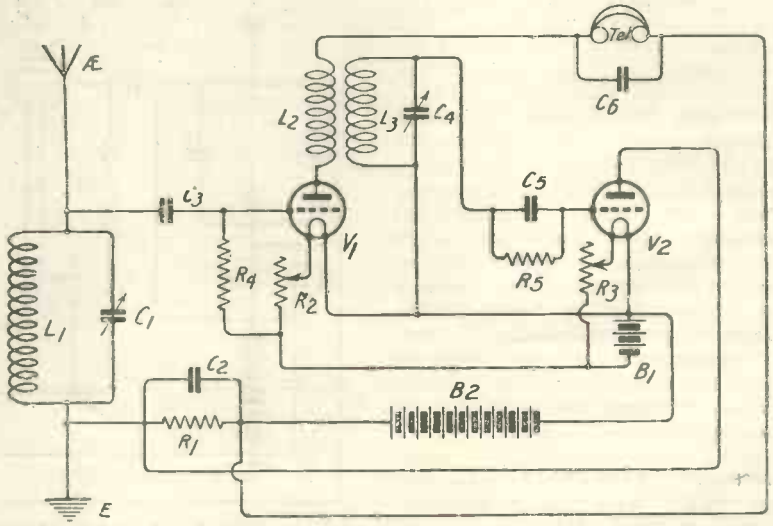


Fig. 3.—This arrangement has certain disadvantages but keeps the aerial circuit clear.

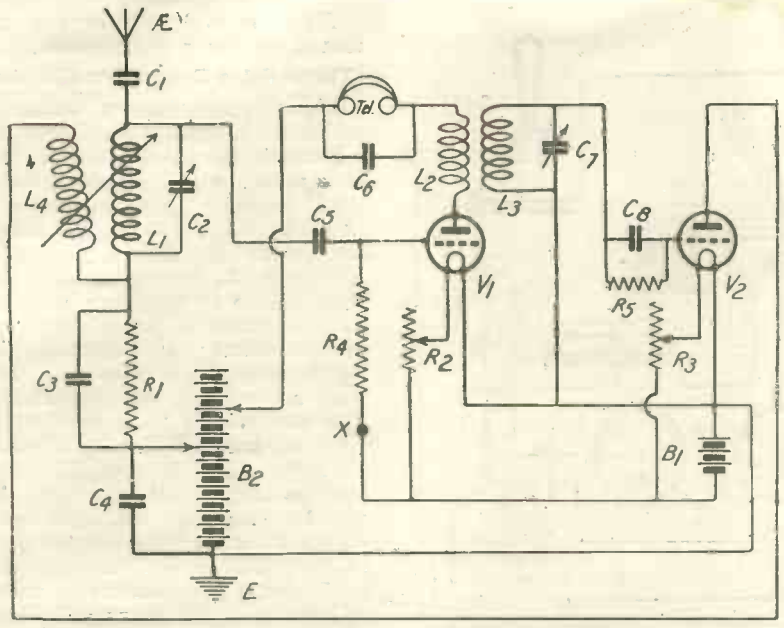


Fig. 4.—The circuit of Fig. 1 with reaction.

other useful principles, simple, and consists in feeding back the low-frequency currents from the rectifying valve through a high resistance of the order of 50,000 ohms, the varying low-frequency potentials across this resistance being communicated to the grid of the high-frequency amplifying valve which will now become a dual valve. The high resistance is connected in the anode circuit of the detector valve and is also preferably connected in the aerial circuit. Feeding into the joint aerial and grid circuits was first described in connection with the improved S.T. 100 in *Wireless Weekly*, and is being rapidly adopted as a standard method of feeding back low-frequency currents in a dual circuit. The advantages of this method of feeding back are so obvious that I naturally embodied the idea in the resistoflex.

A simple resistoflex is shown in Fig. 1. It will be seen that the first valve V_1 acts as a high-frequency amplifier, the aerial circuit containing the constant aerial tuning condenser C_1, the main oscillation circuit $L_1 C_2$, a condenser C_3, another condenser C_4, and the earth. The battery B_2 and the resistance R_1, which has a value of from 20,000 to 100,000 ohms, do not form part of the aerial circuit proper. The high-frequency oscillations produced by incoming signals are communicated through the grid condenser C_5, to the grid grid of the valve V_1. The usual gridleak R_4 is used to prevent an accumulation of electrons on the grid of the valve V_1, and a grid bias battery may be included at the position X to prevent rectification in the grid circuit of the first valve. The condenser C_5 and the leak R_4 have no connection whatever with the first valve acting as a rectifier. On the other hand, this valve should act purely as an amplifier of the high and low-frequency currents. The condenser C_5 is simply for the purpose of insulating the grid of V_1 from the positive terminal of B_2, which is the high-tension battery.

The valve V_1 now acts as a high-frequency amplifier, the amplified oscillations passing through the primary L_2 of a high-frequency transformer $L_2 L_3$. They pass through the by-path condenser C_6 across the telephones and through the condenser C_4 which may have a capacity of 1 microfarad. The amplified oscillations are passed from L_2 into the circuit $L_3 C_7$ which is tuned to the incoming frequency. The second valve V_2 acts as a detector in the ordinary way, and the rectified low-frequency currents in the anode circuit pass through the high resistance R_1, through the high-tension battery B_1 and so back to the filament of the second valve. In passing through R_1, low-frequency potential variations are produced across this resistance, and these are communicated to the grid of the first valve, through the inductance L_1 and through the condenser C_5, the resistance R_1 being not only in the anode circuit of the second valve, but also in the grid circuit of the first. The grid of V_1 will have its normal potential varied at low-frequency by the rectified currents, and these are now amplified by V_1, which is now acting in its dual capacity. The low-frequency currents pass through L_2 and so through the telephones, round the battery B_2 back to the filament of V_1. In doing so they actuate the telephones or the loud-speaker as the case may be.

We therefore have here a stage of high-frequency amplification, rectifying action by the second valve, and a stage of resistance low-frequency amplification.

Great purity of reception is

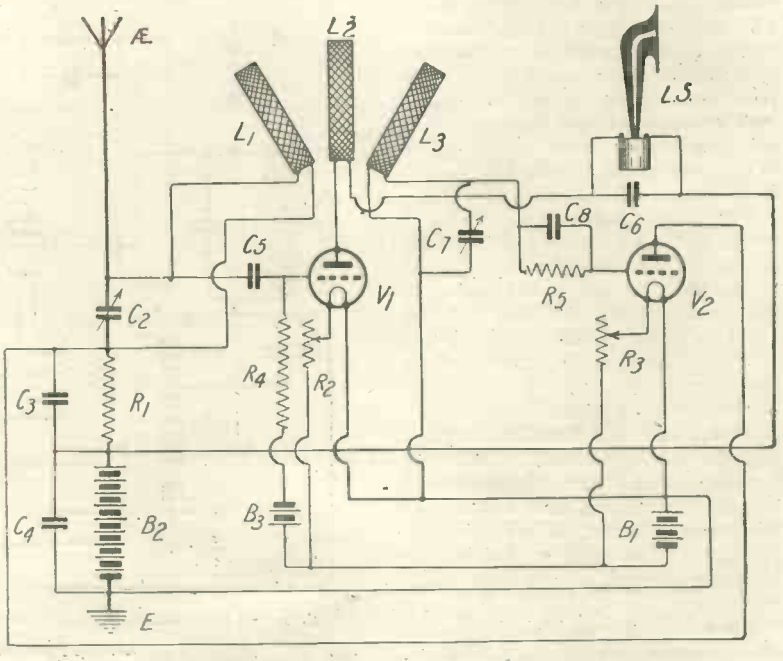


Fig. 5.—A recommended form of resistoflex circuit.

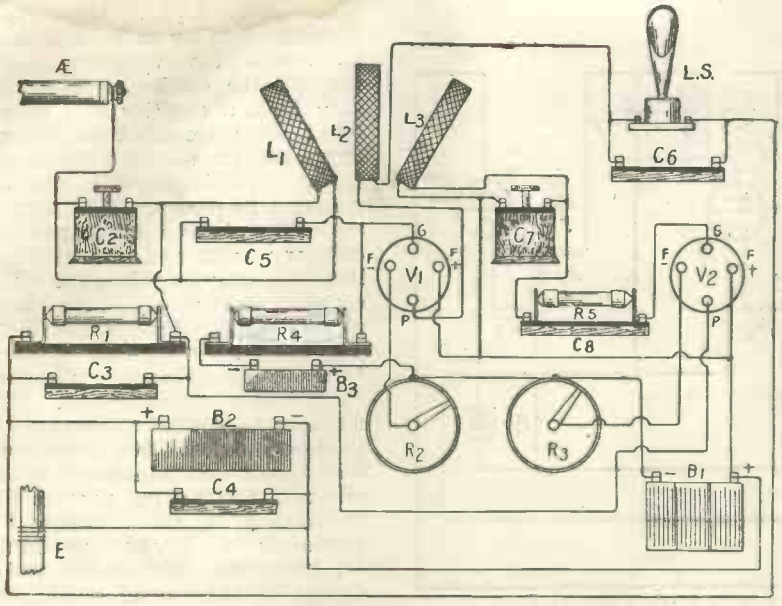


Fig. 6.—Pictorial form of Fig. 5.

obtained, and one of the causes of buzzing is eliminated. On the other hand, we do not completely eliminate the presence of a low-frequency resonant circuit, because the telephones shunted by C_6 form such a circuit. When the three-valve development of Fig. 1 is used (described later), the low-frequency resonant circuit disappears altogether.

Fig. 3 is a modification of Fig. 1 in that the anode resistance is between the earth and the filament battery. This arrangement has certain disadvantages. The aerial circuit, of course, becomes simpler. The disadvantages are the same as those existing when a transformer secondary is connected in the position of the anode resistance. Full reasons for this were given in the September issue of MODERN WIRELESS in the article on "Reflex Receivers in Theory and Practice."

Fig. 4 is a circuit similar to Fig. 1 with reaction from the anode circuit of the second valve applied to the grid circuit of the first. It will be seen that the reaction coil L_4 is included in the anode circuit of the second valve, and that by suitably coupling L_4 to L_1 a reaction effect will be obtained in the aerial, and also into the tuned intervalve high-frequency circuit. Separate tappings off the high-tension battery are shown, and a grid bias battery might be included in the position X in such a position as to make the grid of the first valve negative.

Fig. 5 is a particularly useful embodiment of the resistoflex circuit, tri-coil coupling, described in the last issue of MODERN WIRELESS, being applied to this circuit. The grid coil L_1 should be kept well away from the coils L_2 and L_3 when first tuning in, and L_2 and L_3 will usually be kept close. If, however, there is a tendency towards self-oscillation with L_2 and L_3 too close together, L_3 may be moved to an appropriate distance from L_2. A complete control of reaction is obtained in this way, and this circuit is probably the best one to try out the resistoflex principle.

Fig. 6 is a pictorial representation of the Fig. 5 arrangement.

Three-Valve Resistoflex Circuits

Fig. 7 is a resistoflex circuit in which the amplified low-frequency currents in the anode circuit of the first valve, which is acting as a dual amplifier, are passed, not through telephones or a loud-speaker, but through another anode resistance R_2 having a value of from 40,000 to 100,000 ohms. A suitable value is 50,000 ohms or 100,000 ohms; the difference in signal strength between the two does not seem to be appreciable. The resistance R_2 is shunted by a fixed condenser C_5 having a value of from .0001 to .002 μF. Any intermediate value will do. It will be seen that the right-hand end of R_2 is connected to the grid of the third valve, through the condenser C_8, which has a value of from .002 μF to .25 μF. The gridleak and condenser of the second valve V_2 have the usual values, namely, .0003 μF and 2 megohms. It will be noticed that the bottoms of the two gridleaks R_6 and R_7 are connected to the negative terminal of the filament accumulator B_1; a grid bias battery may be included in the position Y in such a way as to make the two grids negative.

Fig. 8 is a circuit like Fig. 5 with an additional stage of low-frequency amplification, a step-up transformer $T_1 T_2$ being connected in the position shown. The primary T_1 is shunted by a condenser C_9 of .002 μF capacity.

In Fig. 9 we have a circuit

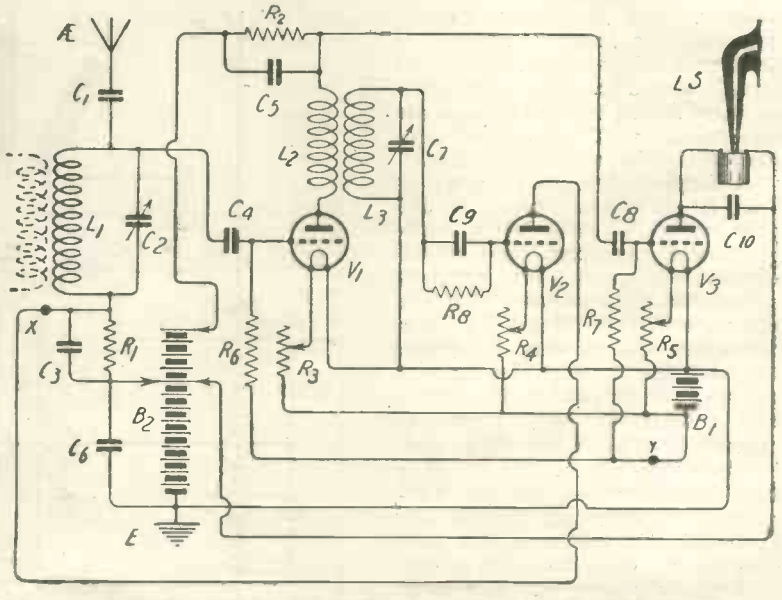


Fig. 7.—The reaction coil shown in dotted lines might occupy the position indicated by x.

like Fig. 5 followed by a stage of resistance amplification. The values of C_4, C_5, C_8, R_2, R_6 and R_7 are the same as those in connection with Fig. 7.

Conclusion

Excellent results have been obtained with this class of circuit, and announcements elsewhere indicate that a full description of a successful set will be shortly described. Buzzing on a circuit of this kind, if it ever occurs, may be due to one or two reasons; either a gridleak howl is obtained, due to the charging and discharging of the grid condenser in the grid circuit of the first valve due to the piling up of electrons on the grid through oscillation of the first valve, or it may be due to a complex effect independent of oscillation circuits. This form of low-frequency buzzing is only obtained in certain resistoflex circuits, and is due to an effect similar to that obtained in the multivibrateur circuits. It is, however, possible

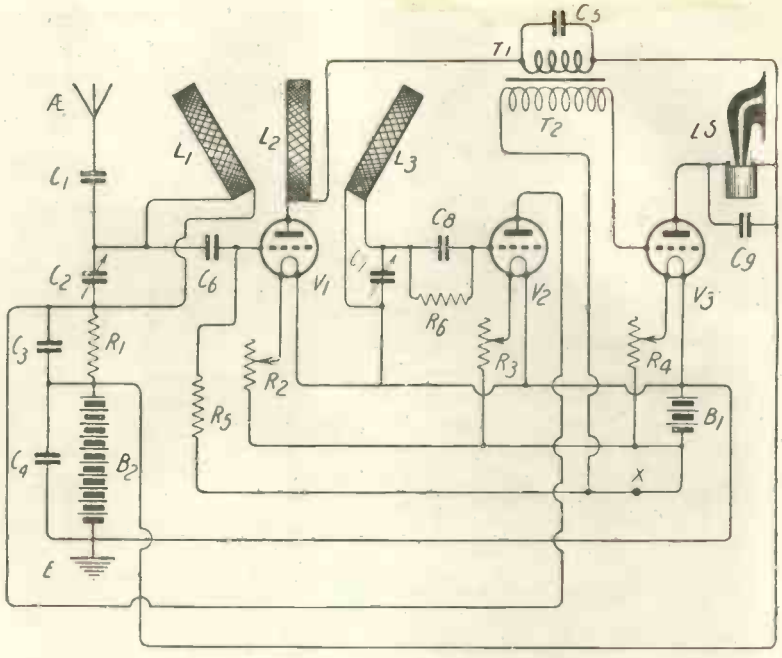


Fig. 8.—A three-valve resistoflex.

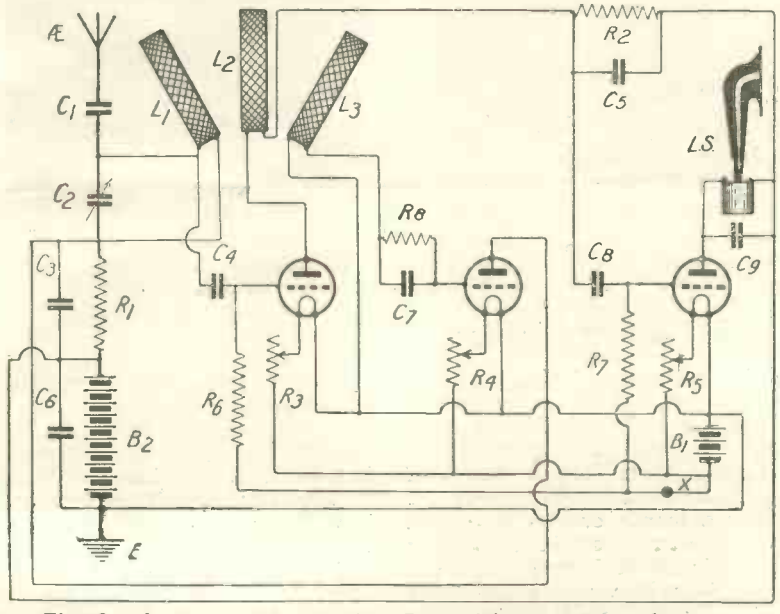


Fig. 9.—A three-valve resistoflex without a transformer.

to overcome this latter effect, if present, and also the former, by suitable adjustment of the grid-leaks and condensers.

Reports from readers will be very welcome as the introduction of new circuits depends for its success upon the ability of thousands of experimenters to fix up the arrangement and obtain the desired results.

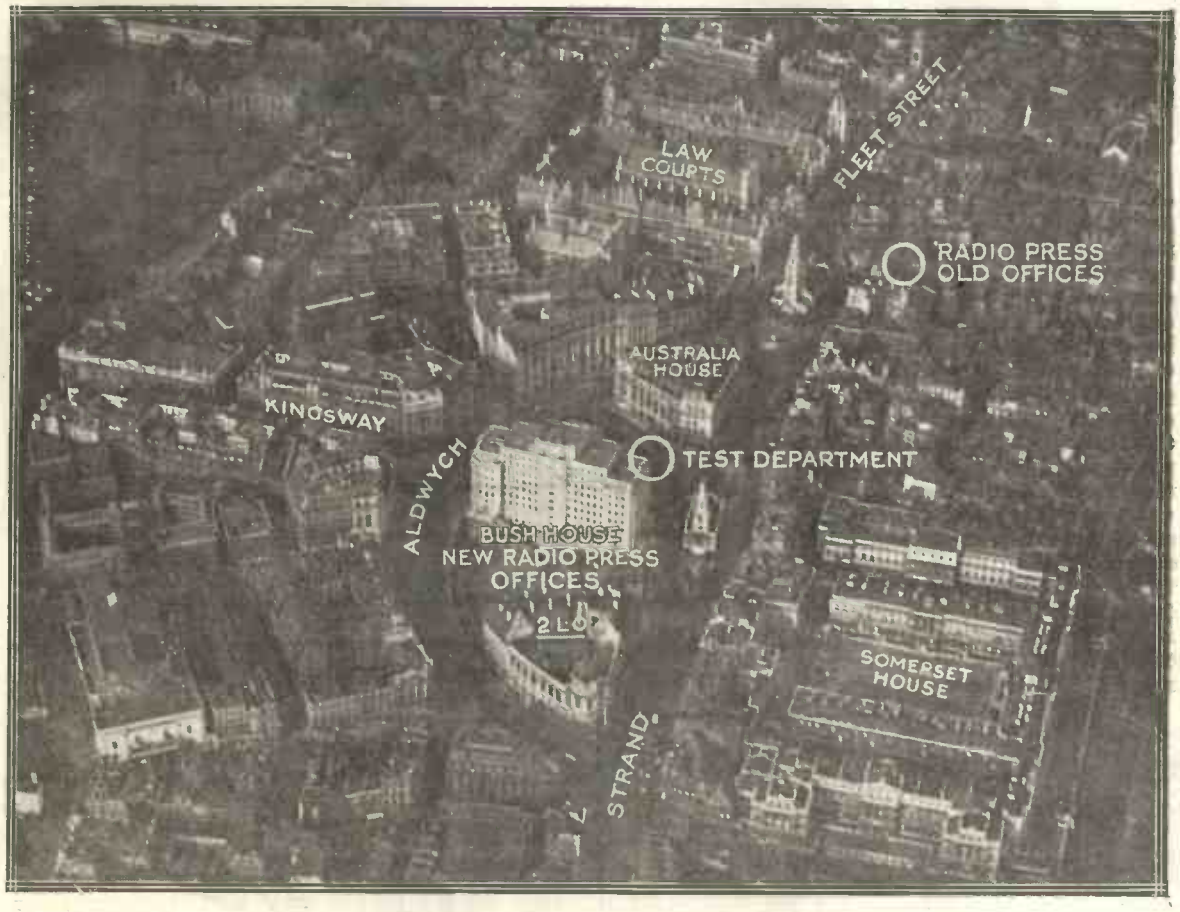
Fig. 5 is certainly the one to try first:

C_2 = .0005 μF.
C_3 = .0003 μF.
C_4 = 1 or 2 μF.
C_5 = .0005 μF.
C_6 = .0003 μF.
C_7 = .0003 μF.
C_8 = .0003 μF.
gridleaks = 2 megohms.
B_3 = 3 volts.
R_1 = 100,000 ohms.

A reversal of leads to the grid coil should always be tried.

IMPORTANT NOTICE

Full advice on the working and construction of a successful 2-valve resistoflex set is given in No. 1 of "THE WIRELESS CONSTRUCTOR," the great new wireless monthly edited by Percy W. Harris, which will be published on October 15. The article will be written by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., himself, and will give the fullest details and also general advice on the resistoflex circuit, the best values of components, etc. Concluding details will be given in No. 2 (November 15), and a full-sized blue print of the wiring will be presented free with this number.



Photo, Aerofilms, Ltd.

A Romance of Fleet Street

A Further Chapter.

IN our issue for August there appeared under the title of "A Romance of Fleet Street" an article from the pen of Mr. Ernest R. Gilbert, describing the work and progress of Radio Press Ltd. To this article must be added a further chapter.

A visitor who to-day strolls into Devereux Court, Strand, looking for the offices of Radio Press Ltd., publishers of MODERN WIRELESS and *Wireless Weekly*, would find that the bird has flown! To change the metaphor from bird to bee, the hive is empty.

No longer will the staff be found distributed through a number of small rooms in an old-world office; the accommodation was too small for the ever increasing activities, and new premises have been sought.

From historic ground in the Temple, Radio Press Ltd. have moved but a few hundred yards to the most modern and palatial business building in London—Bush House. To the Londoner this imposing edifice needs no description—it dominates the Strand and Kingsway by its magnificent architecture, whilst within its splendidly equipped offices are a model of what a business building should be.

For a month or two the work will be carried on in temporary offices in Bush House while the large floor area which has been taken by Radio Press is being fitted out to suit their requirements. In the interval the Service and Test Departments, as well as the Sales Department, are temporarily housed in wooden buildings in Melbourne Place, between Bush House and Australia House. The Editorial and Accountants' Departments are within the main building. Steps have already been taken to erect on the roof a special aerial, which from its point of vantage will pick up waves with ease from any direction.

One of the chief advantages of the change of premises is that it will be possible to concentrate the whole of the activities of the company upon one huge floor, thus effecting many economies in time and energy when communication between different departments is needed. To do this, of course, a large floor space is required, and it will not surprise those readers who are acquainted with the activities of a great publishing house to know that the new offices occupy an area of over five thousand square feet. Here will be carried out the editorial work connected with MODERN WIRELESS, *Wireless Weekly*, and *The Wireless Constructor*, the preparation of the series of technical books which have done so much to enhance the reputation of Radio Press Ltd., the hundreds of technical drawings necessary for all these publications, the answering of thousands of readers' queries which flow into the offices, the mail order department from which books and magazines are despatched to every quarter of the globe, and the routine business work connected with the whole firm.

The New Home of Radio Press Ltd.

THE ALDWYCH ENTRANCE TO BUSH HOUSE

Only a few minutes walk from Fleet St., Bush House forms an ideal home for the largest wireless publishing house in the world. In the picture above, our artist has caught the spirit of the building by a true rendering of the magnificent main entrance.

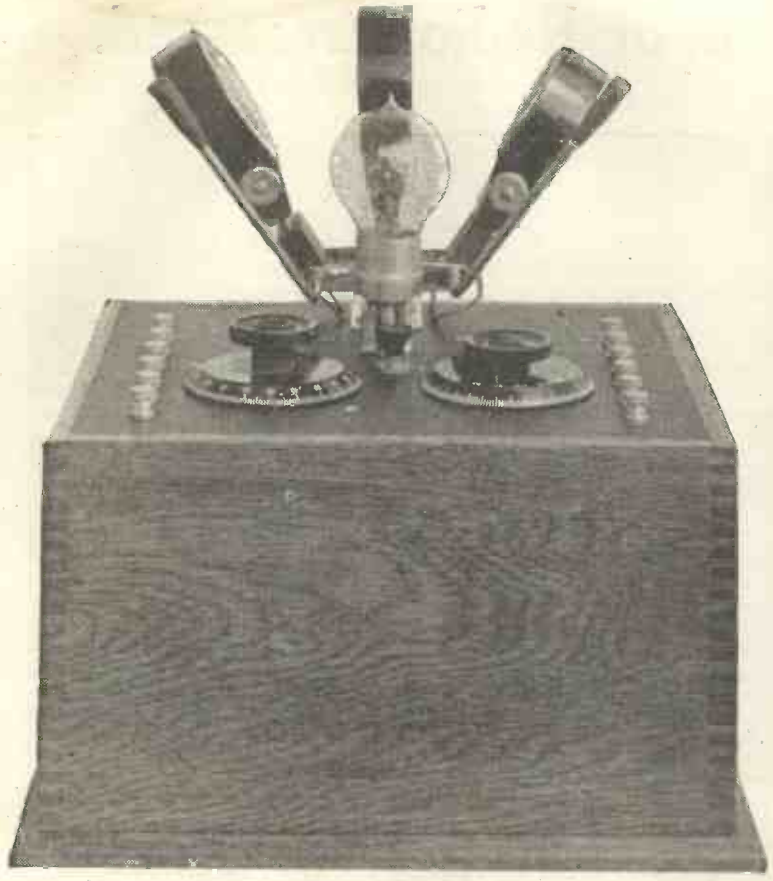


Fig. 1.—The symmetrical and compact lay out will be seen in the above photograph.

A Loose-Coupled Single Valve Reaction Receiver

By

STANLEY G. RATTEE

Member I.R.E., Staff Editor.

If you are troubled by interference this set will help you.

THE subject of eliminating interference is one of ever-increasing interest, and the following article giving full details for the construction of a loose-coupled receiver should appeal to coast dwellers and others.

The increasing number of broadcasting stations in this and other countries is making the subject of interference elimination not only one of considerable interest, but one of general importance, for without selective tuning the reception of many of the stations is a practical impossibility without the introduction of wavetraps or other devices.

Though when designing receivers most authors devote considerable attention to the sensitiveness of the finished instrument, there are few who give the same attention to the question of selectivity. The reason for this is that the operation of selective circuits is a far more complicated business than is the case when tuning the single circuit type of instrument, and for the benefit of his readers the author avoids the complication. Experience, however, goes to show that once a selective circuit has been successfully operated any extra patience and practice expended in the mastery of the circuit is amply repaid in the delight afforded by the ability to select the desired station from a babble of noises and mush.

Of all the various forms of eliminating interference one of

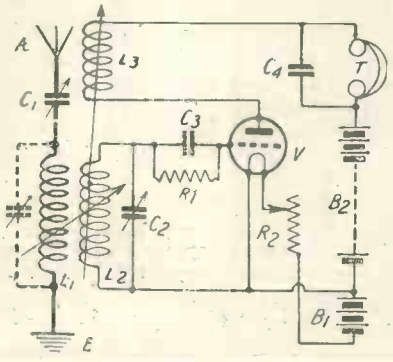


Fig. 2.—The theoretical circuit, using the loose-coupled arrangement.

the most successful is that in which the aerial circuitis inductively coupled to a secondary or closed circuit.

The means by which such indirect coupling between two separate receiving circuits may be made are, first, that in which the aerial circuit consists of relatively few turns of wire wound directly upon the secondary circuit and untuned, and, secondly, that in which the coupling between the aerial and secondary circuit coils may be varied, both aerial and secondary circuits being tuned. This latter arrangement is what is known as loose-coupling, and is the form of coupling employed in the receiver to be described.

Considerations in Design

In order to make the wavelength range of the receiver as broad as possible the popular method of using plug-in coils is employed, together with a three terminal arrangement, which has been many times described in this journal, permitting the aerial tuning condenser to be used either in the series or parallel position.

Some conception of the general arrangement of the receiver may be gathered from the photographs. The six terminals seen on the left of panel permit the use of loose-coupled tuning with series or parallel aerial condenser or single circuit tuning

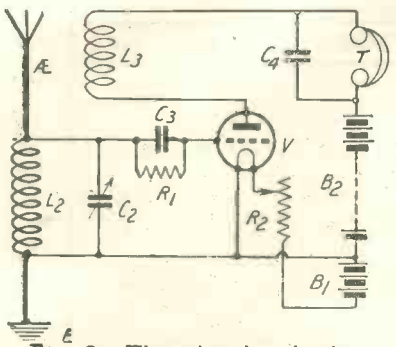


Fig. 3.—The simple single-circuit arrangement.

with or without constant aerial tuning. The six terminals on the right-hand side of the panel are for the batteries and telephones. The disposition of the components as well as the general make up of the receiver may be gathered from the photographs showing both top and underside of panel views; the simplicity of the wiring may also be observed.

The Circuit

One of the chief difficulties when deciding upon a design for a loose-coupled valve receiver is the application of reaction to the tuned circuits. First, reaction may be applied to the aerial coil, secondly, it may be coupled to the secondary coil, or one may use the circuit known as the "split secondary"; this latter arrangement constitutes the dividing of the secondary winding into two halves, one half being coupled to the aerial coil and the other half being coupled to the reaction coil, in the manner described by Mr. Kendall in the September 10th issue of *Wireless Weekly*. The circuit finally decided upon for this receiver was that illustrated in the theoretical circuit diagram wherein it will be seen that the reaction coil is coupled to the secondary circuit. The reason why this arrangement was chosen was in order to permit the receiver to be used with single circuit tuning, still employing reaction, without the necessity of including a "tune-standby" switch. Had the reaction coil been coupled to the aerial circuit this switch would have become necessary to connect the aerial coil across the grid and filament of the valve.

It will be seen that if we connect aerial to A_1, Fig. 4, and earth to E, leaving the remaining terminals free, the circuit becomes a loose-coupled arrangement with series condenser in the aerial circuit; if, on the other hand, we connect the aerial to A, join A_1 and E together, still making our earth connection at E, we have the same circuit, but using parallel condenser in the aerial circuit.

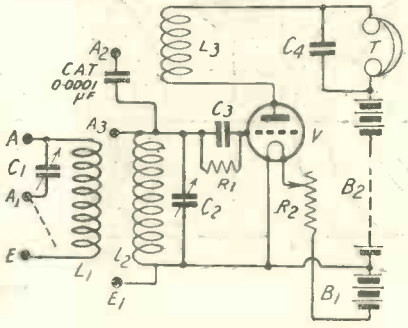


Fig. 4.—Diagram showing terminals to use for direct or loose-coupled circuits.

If, on the other hand, we connect the aerial to A_2 and the earth to E_1, leaving the remaining terminals free, we have a single circuit arrangement with constant aerial tuning; similarly, if we connect the aerial to A_3 and the earth still to E_1, leaving the remaining terminals free, we have the same circuit without constant aerial tuning.

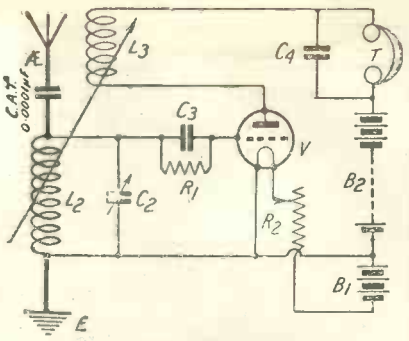


Fig. 5.—Fig. 3 arrangement with C.A.T. added.

The three simplified circuits will make clear to readers the three arrangements which are possible by the correct use of the six terminals on the left-hand side of the receiver.

Components and Materials

The receiver as illustrated is made up with the following components and materials, the names of manufacturers being given for the assistance of readers. This information is not intended, however, to bind readers to any particular makes, but is merely for their guidance should they desire it; so far as values are concerned it is essential that these be respected, as any departure from these figures, which have been arrived at by experiment, may result in either the receiver not working efficiently or else not covering the wavelengths it should be capable of tuning.

One ebonite panel measuring 9 in. by 10 in. by ¼ in.
One three-coil holder (Burne-Jones).
One variable condenser of 0.001 μF (Radio Instruments, Ltd.).
One similar condenser of 0.0005 μF (Jackson Bros.).
One fixed condenser of 0.0003 μF (Dubilier).
One fixed condenser of 0.002 μF (Dubilier).
One fixed condenser of 0.0001 μF (Dubilier).
One grid leak of 2 megohms resistance (Dubilier).
One Lissenstat minor
One valve socket or alternatively four valve socket pins.
Twelve brass terminals.
Quantity of connecting wire.
One pair 2,000 or 4,000 ohm telephones.

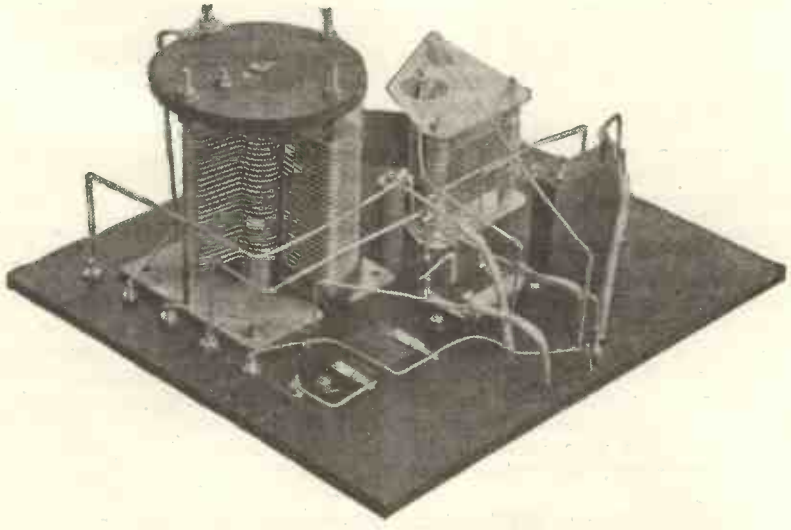


Fig. 6.—The spacing of the connections may be seen in the photograph.

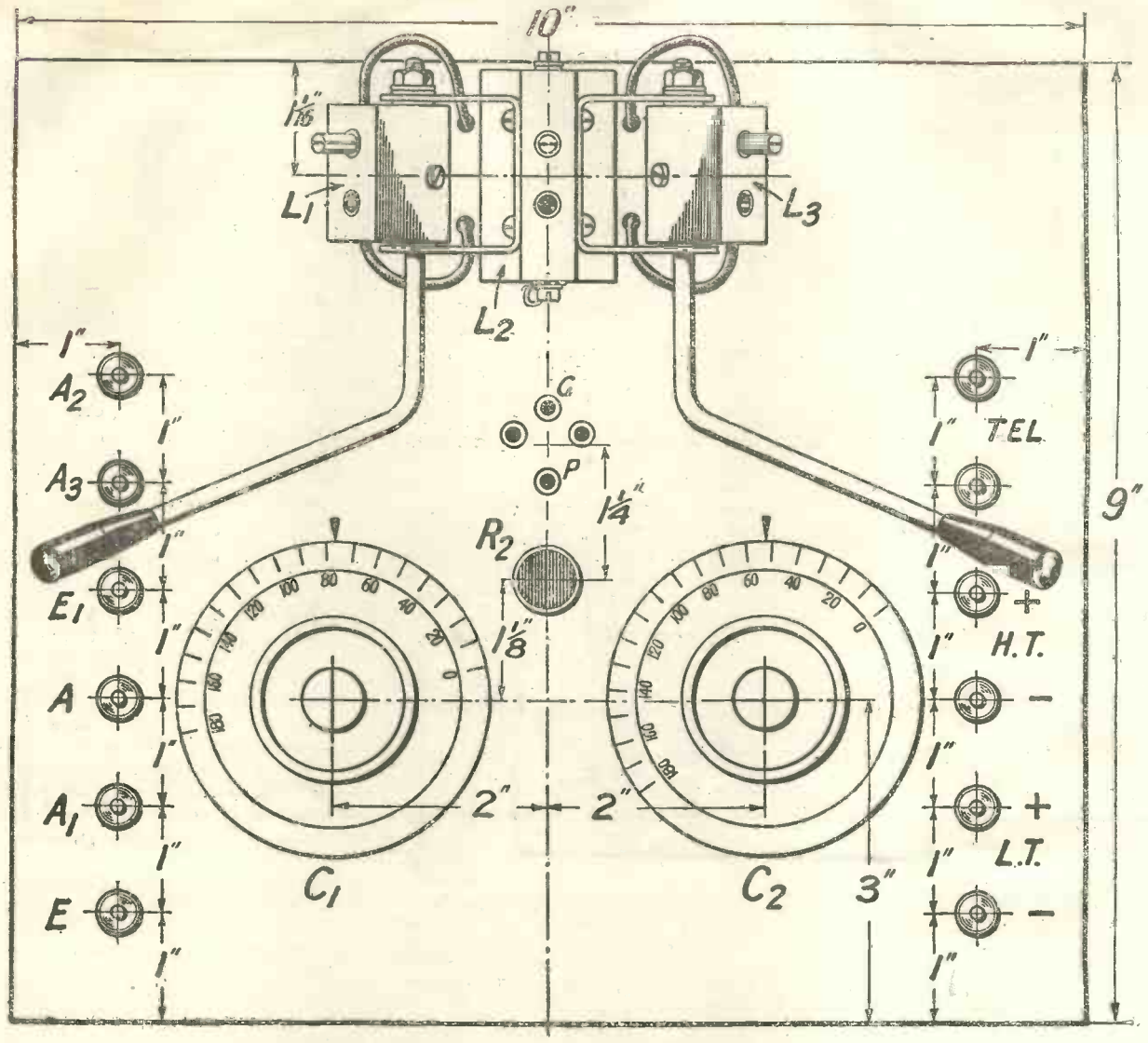


Fig. 7.—Dimensioned plan of front of panel. Blue Print No. 67A.

One accumulator (suitable for the valve chosen).
One H.T. battery of about 60 volts.
One valve (bright or dull emitter).
Set of plug-in coils for the wavelengths desired.

The Panel

This is made from the ebonite sheet appearing first in the list of components and is drilled in accordance with the instructions given in the illustration of the panel layout. When purchasing the ebonite for this panel readers should ascertain whether or not the material is guaranteed to be free from surface leakage. This precaution is necessary in that there are now on the market ebonites of both types, that is, guaranteed and unguaranteed; whenever possible the former should be purchased, but in cases where only the latter is obtainable, after the drill holes have been made, the surface skin should be removed by means of rubbing both sides with emery paper, the final finishing being made with a soft rag and a drop of oil to retrieve the deep black it originally possessed.

Wiring the Receiver

An examination of the photograph showing the underside of the panel will make it clear to readers that the wiring of this receiver does not call for any more than ordinary skill; it will be further observed that the method of wiring is that of stiff wire without the use of systoflex, all connections being soldered.

For some reason constructors sometimes anticipate difficulty in wiring receivers with stiff wire, preferring the easier method of using soft tinned copper and insulating sleeving; in those cases where this difficulty is anticipated the use of soft wire and sleeving should not, of course, affect the general efficiency of the receiver, and may be used so long as the leads are well separated, kept short, and connections are soldered.

Valves

Since this receiver is fitted with a filament resistance suitable for either bright or dull emitter valves any general purpose receiving valve may be used. When operating this receiver particular attention should be paid to the H.T. voltage applied to the plate of the valve, as when using the loose-coupled arrangement any excess of H.T. voltage will cause the receiver to oscillate badly; for information

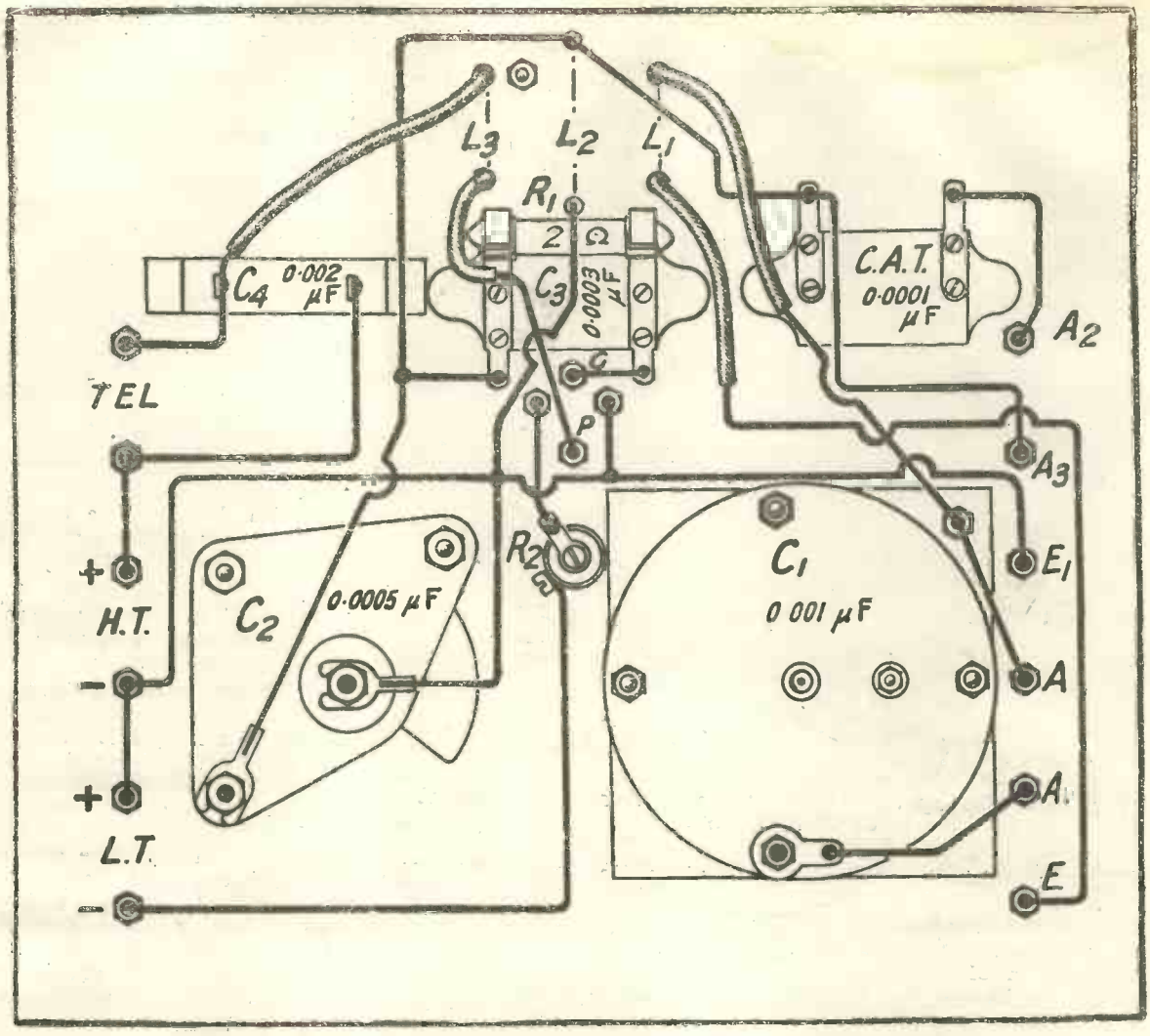


Fig. 8.—Back-of-panel wiring diagram. Blue Print No. 67B.

concerning the H.T. values for the particular valve chosen the reader is advised to read the instructions given by the manufacturers upon or within the wrapper containing the valve.

Operating the Loose-Coupled Arrangement

With the receiver finally completed connect the accumulator, H.T. battery and telephones in accordance with the terminal markings given in the panel layout. Turn the filament resistance to the "off" position and insert the valve.

At this point connect the aerial to A_1 (series condenser), the earth to E, and insert in the aerial coil socket, that is, the moving socket on the left, a No. 50 coil. In the centre socket (secondary circuit) insert a No. 75 coil, and in the reaction coil socket (moving socket on right) insert a No. 50 coil; with these three coils mounted, set the two moving coils at right angles to the centre coil and light the valve to a suitable degree of brilliancy.

The operation of tuning is to place the aerial coil fairly close to the secondary coil and to tune with the two condensers simultaneously; if no signals are heard move the aerial coil a little nearer to the fixed coil and again tune with the condensers. When signals have been tuned to their loudest, adjust the aerial tuning condenser alone, bringing the aerial coil nearer to the fixed, or moving it farther away, according to results; when the loudest signals are obtained in this manner make further adjustments with the secondary condenser, again varying the coupling between the two coils.

At this stage slowly move the reaction coil nearer to the fixed coil, at the same time making further adjustments on the secondary condenser, taking care that the set does not oscillate. With the best results obtained in this way vary the coupling slightly between all three coils, making final adjustments upon the two condensers.

Eliminating Interference

The careful handling of this circuit will, in most cases, either permit the complete elimination of interference with a certain loss in signal strength of the station desired or else reduce the strength of the interference to such a degree that the desired signals will predominate.

In the majority of cases this condition of things is brought about by the separation of the aerial and secondary coils as far as the reception of the desired signals will permit. The aerial tuning condenser should in all cases be tried in both series and parallel positions.

When making these tests it may be found that the receiver will not

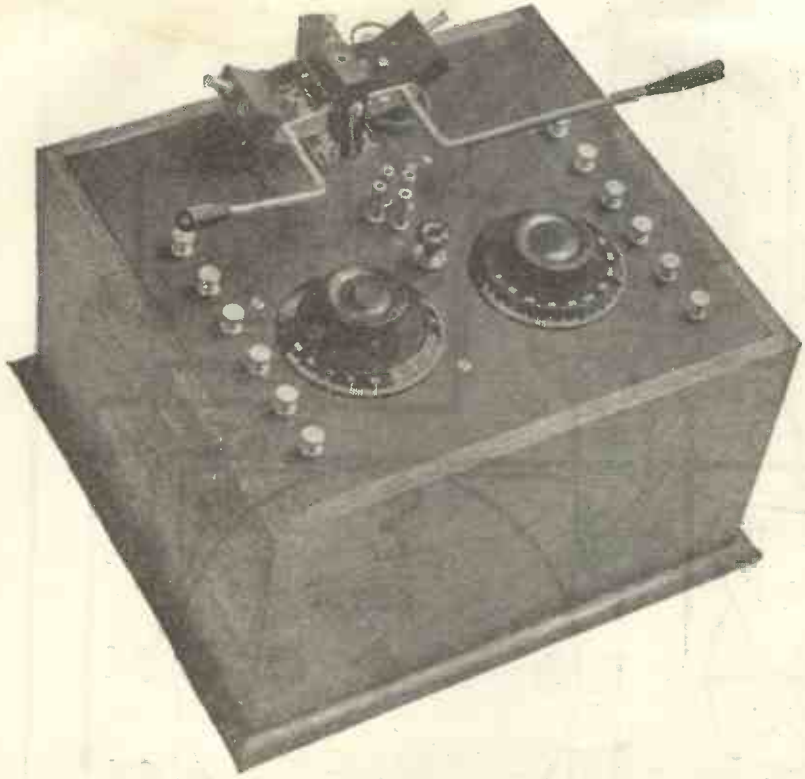


Fig. 9.—A photograph showing the general arrangement of components.

oscillate, in which case the connections to the three coil holder should be carefully checked with those given in the wiring diagram. The condition of oscillation will make itself known by a pronounced "plock" whenever either the aerial coupling is loosened or the reaction coil is moved too near the secondary; continuing the movement of either of these coils after the "plock" is heard will cause the receiver to howl. Readers should in all cases be extremely careful to keep well clear of this oscillating condition, otherwise considerable discomfort will be caused to other listeners.

Coils to Use

When using the loose-coupled circuit the following coil sizes should be used; in all cases where the B.B.C stations are being received both series and parallel condenser should be tried, using for the lower waveband, with series condenser coil No. 50 in the aerial, No. 50 in the secondary, and No. 50 for reaction; for the higher waveband up to 500 metres coils No. 50 or 75 should be used in the aerial with a No. 75 as secondary and a No. 50 or 75 for reaction.

Other coil sizes are, with the aerial condenser in parallel:—

Shipping, aerial No. 50 or 75, secondary No. 100, reaction No. 75 or 100. 5XX and Radio Paris, aerial No. 150, secondary No. 250, reaction No. 200 or 250.

Single Circuit Tuning

Using the receiver with single circuit tuning the fixed coil socket now becomes the aerial coil socket, reaction being as before. The operation of this circuit is best carried out by using for the lower wavelengths, constant aerial tuning, that is, connecting the aerial to A_2 and the earth to E_1, leaving the remaining terminals on the left-hand side of the receiver quite free.

For the reception of B.B.C. stations with wavelengths up to 400 metres a No. 50 coil should be inserted in the fixed coil socket with a No. 75 for reaction; the two coils should be turned at right angles to each other, and the valve lighted as before. Tuning is made upon the 0.0005 μF condenser (the 0.001 condenser being out of circuit) until the best results are obtained, when the reaction coil is brought slowly nearer to the fixed coil, at the same time making further adjustments upon the condenser.

For the reception of B.B.C. wavelengths above 400 metres the same instructions hold good, with the exception that a No. 50 or 75 coil is used in the aerial socket.

Those readers who desire to receive higher wavelengths than these may use for the reception of 5XX or Radio Paris, a No. 200 coil for the aerial (with the aerial still connected to A_2), and a No. 250 for reaction. The same stations may be received without constant aerial tuning by connecting the aerial to A_3, using a No. 150 coil for the aerial and No. 200 for reaction.

With the aerial connection still made to A_3 the reception of the Eiffel Tower, Paris, may be made by using a No. 250 coil for the aerial with a No. 300 for reaction.

The operation of the receiver as a single circuit arrangement is precisely the same whether constant aerial tuning is employed or not, with the difference that the receiver oscillates more freely when using constant aerial tuning.

Test Report

With the receiver as illustrated and connected to a small aerial in S.E. London, and using the loose-coupled arrangement during the transmission of 2LO, Birmingham, Bournemouth, Newcastle and Cardiff were successfully received without interference from 2LO. 5XX was also received at good strength upon the same arrangement, the tuning of Radio Paris also being effected without interference from 5XX. With single circuit tuning Birmingham, Bournemouth, Cardiff and Newcastle were received during intervals of 2LO at good strength; 5XX, Radio Paris, the Eiffel Tower, and Madrid were also received without difficulty.

Though this receiver when used as a loose-coupled instrument will be found at first to be somewhat tricky in its adjustments, a little practice in the operation of tuning will soon reveal to the operator the advantages which loose-coupled circuits offer over the single types. For coast dwellers and those who live near to a broadcasting station a receiver made to the specification of that described will prove to be the most suitable, subsequent results justifying any little difficulties which may be experienced during the first operation of the circuit.

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(REGISTERED TRADE MARK)

NEW GECOPHONE Models for 1924/25

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Two · Valve Sets (Det. & L.F.) in Table and Cabinet Models
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In the construction of the new GECOPHONE Models it has been the aim to produce sets which combine the finest results with simplicity of operation and handsome appearance. The range of 1924/5 models has been considerably extended to meet every requirement. They embody to the fullest extent the same superlative qualities which have given the original GECOPHONE Model its unrivalled reputation.

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A Crystal or a 5-Valve Set
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To use a Loud Speaker or Headphones
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To use Accumulator or Dry Batteries
To get the best value for money

and to ensure the maximum pleasure from broadcasting

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Royal Albert Hall, London, September 27-October 8
CALL AT STANDS Nos. 51 and 53
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"The Wireless Constructor"

A Great New Radio Press Venture

OUT OCTOBER 15th

INSERTED in every copy of this issue is a coloured reproduction of the cover of the New Radio Press magazine, *The Wireless Constructor*, the first copy of which will be on sale on October 15th. It is estimated that in a few weeks the millionth wireless licence in this country will be issued, and it is fitting that the well-known wireless organisation should celebrate the occasion by publishing a magazine possessing the well-known Radio Press features of interest and technical reliability combined with certain unique features having very wide appeals.

The Wireless Constructor will sell at the extremely modest price of 6d. monthly in spite of the remarkable value given.

The Editor

MODERN WIRELESS readers will be interested to learn that the editorship of the new journal has been entrusted to Percy W. Harris, Assistant Editor of MODERN WIRELESS and *Wireless Weekly*, whose work for the Home Constructor is well known throughout the world. The new journal being pre-eminently a "constructor's" paper, all who are interested in the designs published in MODERN WIRELESS will find it very much to their taste. The new magazine will not, of course, interfere in any way with Mr. Harris's articles in MODERN WIRELESS and *Wireless Weekly*, and scope of the paper will be such that there will not be the slightest overlapping with our two highly successful existing periodicals.

Real Selectivity at Last

One of the most interesting features of the new magazine will be a practical description of a remarkable new receiver, designed by Mr. Harris, using only three valves yet obtaining results equal to those of many sets using four or five. It is not a reflex circuit, but a form of neutrodyne receiver in which the maximum amplification is obtained with the advantages of a loose coupled circuit which makes high selectivity comparatively easy to obtain. It is, in fact, ideal for the man who is at present unable to obtain the selectivity he requires in his particular locality. The particular feature of this set is the long ranges obtainable — the aim of all keen experimenters.

Continental stations and other B.B.C. stations will come in with ease on this set which Mr. Harris —the designer—considers his best design yet published—and his experience in these matters is unrivalled.

Simple Sets

Mr. Harris also contributes constructional articles on a very cheap and simple single valve set and also a crystal set. There will be highly efficient "Harris" sets in every issue of the *Wireless Constructor*, and every reader of MODERN WIRELESS will want to buy the copies as they are published. Any two pages of this new full-size magazine will be more than worth the modest sixpence.

The Radio Press—the proprietors of the *Wireless Constructor*—are printing 175,000 copies of No. 1, certain as they are of the great success which awaits their new magazine, which will be backed by the largest radio publishing organisation in the world. Not only MODERN WIRELESS and *Wireless Weekly* readers will buy this paper, but tens of thousands of wireless beginners will start with No. 1, and there will be many articles of special interest to such readers.

Mr. Harris has won such a high reputation in the constructional field that those who find the monthly wait for his designs too long will eagerly welcome this mid-monthly magazine which will be published on the 15th of each month—half-way between issues of MODERN WIRELESS.

The Resistoflex Receiver

Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., the Editor of MODERN WIRELESS, will be describing the construction of a practical Resistoflex receiver, and that feature alone will create a huge demand for No. 1 of the *Wireless Constructor*.

A notable contribution on coils by the well-known coil expert, Mr. G. P. Kendall, B.Sc., will add to the popularity of the issue, which will contain a number of special features which cannot be revealed before publication, for obvious reasons.

We can only state here a few of the good things which will appear in this fully illustrated and beautifully produced monthly magazine.

Free Gift

A free gift will be presented with every copy of No. 1 of the *Wireless Constructor*, and this alone will be worth far more than the mere price of the magazine.

In short, the *Wireless Constructor*, while not clashing in any way with MODERN WIRELESS and *Wireless Weekly*, will maintain the highest traditions of the Radio Press. Nothing the Radio Press has yet produced has failed to obtain the fullest support from the world of wireless. The *Wireless Constructor*, we are confident, will be the greatest success the Radio Press has yet produced.

The first issue of *Modern Wireless* was sold out within a few hours of publication and thousands of people were disappointed even after two reprints. To avoid a similar disappointment place your order at once.

Regular Programmes from Continental Broadcasting Stations

Times in Greenwich Mean Time

Edited by CAPTAIN L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S.

WEEK DAYS.

G.M.T.	Name of Station.	Call Sign and Wave Length.	Locality where situated.	Nature of Transmission.	Closing-down time or approx. duration of Transmission.
a.m.					
6.40	Eiffel Tower	F.L. 2600 m.	Paris	Weather Forecast	5 minutes.
7.00	Munich	——486 m.	Bavaria	Market Prices	10 minutes.
7.55	Persbureau M.S. Vaz Dias.	P.C.F.F. 2125 m.	Amsterdam	Stocks, Shares and News	10 minutes.
9.00	Voxhaus	——430 m.	Berlin	Stocks and Shares	3 minutes.
9.15	Voxhaus	——430 m.	Berlin	News	10 minutes.
9.23	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 minutes.
9.40	Eiffel Tower	F.L. 2600 m.	Paris	Cotton and Coffee quotations	5 minutes.
9.55	Persbureau, M.S. Vaz. Dias.	P.C.F.F. 2125 m.	Amsterdam	Stocks, Shares and News	10 minutes.
10.00	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark).	5 minutes.
10.30	Lyons	Y.N. 470 m.	Lyons	Concert	Until 11 a.m.
10.44	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 minutes.
10.55	Eiffel Tower	F.L. 2600 m.	Paris	Fish Market quotations (Mondays excepted).	5 minutes.
10.55	Frankfurt	——467 m.	Frankfurt	Time Signal (spoken) followed by news.	10 minutes.
11.10	Persbureau M.S. Vaz Dias.	P.C.F.F. 2125 m.	Amsterdam	Stocks, Shares and News	Until 11.30
11.14	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in Greenwich Time (Spoken), followed by Weather Forecast.	5 minutes.
11.15	Voxhaus	——430 m.	Berlin	Stock Exchange News	5 minutes.
11.55	Voxhaus	——430 m.	Berlin	Time Signals (spoken) followed by News.	10 minutes.
11.55	Breslau	——415 m.	Silesia	Time Signal (spoken) followed by Weather Report and Stock News.	15 minutes.
11.57	Nauen	P.O.Z. 3100 m.	Berlin	Time Signal in G.M.T. (Spark)	8 minutes.
noon.					
12.00	Persbureau M.S. Vaz Dias.	P.C.F.F. 2125 m.	Amsterdam	Stocks, Shares and News	10 minutes.
12.00	Leipzig	——452 m.	Leipzig	Stock Exchange and General News	5 minutes.
12.15	Geneva	H.B.1 1100 m.	Switzerland	Weather Forecast, followed by Lecture.	One half-hour.
p.m.					
12.30	Radio-Paris	S.F.R. 1780 m.	Clichy	Items of News	15 minutes.
12.45	Radio-Paris	S.F.R. 1780 m.	Clichy	Concert (Light Orchestra), followed by Exchange Opening Prices.	1.45 p.m.
12.45	Persbureau M.S. Vaz Dias.	P.C.F.F. 2125 m.	Amsterdam	Stocks, Shares and News	10 minutes.
1.00	Haeren	B.A.V. 1100 m.	Brussels	Weather Forecast	5 minutes.
1.00	Munich	——486 m.	Bavaria	News and Weather Report	10 minutes.
1.15	Voxhaus	——430 m.	Berlin	Stock Exchange News	5 minutes.
2.40	Eiffel Tower	F.L. 2600 m.	Paris	Stock Exchange Intelligence (Saturdays excepted).	8 minutes.
2.40	Persbureau M.S. Vaz Dais.	P.C.F.F. 2125 m.	Amsterdam	Stocks, Shares and News	10 minutes.
3.00	Centocelle	I.C.D. 1800 m.	Italy	Weather Report	10 minutes.
3.30	Stuttgart	——437 m.	Wurtemburg	Light Orchestra, followed by Weather Report.	Until 5 p.m.
3.30	Frankfurt	——467 m.	Frankfurt	Music by Station Orchestra	Until 5 p.m.
3.30	Leipzig	——452 m.	Leipzig	Concert	Until 4.30 p.m.
3.55	Persbureau M.S. Vaz Dias.	P.C.F.F. 2135 m.	Amsterdam	Stocks, Shares and News	10 minutes.
4.00	Geneva	H.B.1 1100 m.	Switzerland	Lecture	One hour.

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Like the narrow, concentrated beam of a searchlight—that's how LISSENAGON COILS TUNE—so sharply and so strongly, because each coil is designed and made to respond to a certain band of frequencies "within the beam," and to bar out all other frequencies.

They are essential coils for the experimenter, who wants coils that tune without loss of energy—coils that tune so sharply that they bring in distant stations that cannot be heard as soon as any other make of coil is plugged in.

The user of LISSENAGON COILS has an immense advantage on distant telephony. And while LISSENAGON COILS are more efficient than any other, they are freely interchangeable with them.

HOLD A LISSENAGON COIL UP TO THE LIGHT.

LISSENAGON TUNING CHART. Note the Intermediate Coils, 30, 40, and 60

TABLE I. Wave-length range when used as Primary Coils with Standard P.M.G. Aerial and .001 mfd. condenser in parallel.			TABLE II. Wave-length range when used as Secondary Coils with .001 mfd. condenser in parallel.		
No. of Coil.	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	PRICE.
25	285	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	625	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/6
150	965	2,300	700	2,150	7/7
200	1,885	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2

A CONDENSER THAT COMBINES ALL CAPACITIES—

1. It is a condenser which is immune from stray capacity effect—a station 1,000 miles away could be tuned in with the hand actually around the condenser, and perfect, exact tuning accomplished.

2. It has a negligible minimum—so small indeed that it can hardly be measured. YET IT HAS A MAXIMUM OF .001 rated (actually it is more than this).

3. Can be used as a vernier, a .00025, a .0005, a .001, or where any capacity is specified between a negligible minimum and .001 maximum.

4. Tunes through 710 degrees of scale.

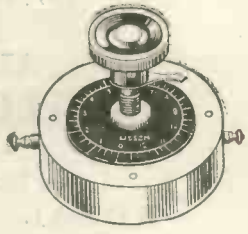
5. POINTER MAKES TWO REVOLUTIONS—on the first revolution the change of capacity is small—use it therefore as a vernier on the first revolution. On the second revolution the changes of capacity are quicker and more critical.

ONE KNOB CONTROL ONLY.—LISSEN ONE HOLE-FIXING, OF COURSE.—TABLE OR PANEL MOUNTING WITHOUT ALTERATION.

IT IS ESSENTIALLY A LOW-LOSS CONDENSER.

A GREAT DEAL OF EXPERIMENTING WAS DONE TO MAKE IT CONFORM TO A STRAIGHT LINE WAVE-LENGTH CURVE — BUT IT IS WORTH THE TROUBLE. IT IS A WONDERFULLY NICE CONDENSER TO TUNE WITH. PRICE **17/6**

THE BEST TUNING COMBINATION YOU CAN GET—LISSENAGON COILS AND THE LISSEN MARK 2 MICA VARIABLE CONDENSER.



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Lissen Variable Grid Leak 2/6

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With all LISSEN Parts it will be a fascinating thing for you to feel your receiver actually GROWING STRONGER AS YOUR OWN SKILL IMPROVES—IT IS FOR YOU TO TAP THAT RESERVE OF POWER WHICH LIES BENEATH THE SURFACE OF EACH ESSENTIAL LISSEN PART. Don't mix your parts.

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Lissenstat	**7/6**
Lissenstat Minor ...	**3/6**
Lissenstat Universal	**10/6**

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—and ensure perfect reception. Remember that valve sets are only as good as the valves used in them.

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are the valves sold in the familiar purple box. They are the valves which bear the name "Marconi"—the valves made at the famous Osram Works. These two great names—Marconi and Osram—are your positive assurance of perfect performance.

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September 27th to October 8th

THE M.O. VALVE CO., LTD.

STAND No. 21

Announcement of The M.O. Valve Co., Ltd.

In replying to advertisers, use COUPON on last page

G.M.T.	Name of Station.	Call Sign and Wave Length.	Locality where situated.	Nature of Transmission.	Closing-down time or approx. duration of Transmission.
p.m.					
4.30	Radio–Paris	S.F.R. 1780 m.	Clichy	News, followed by Concert and late News	Until 4.45 p.m.
4.30	Eiffel Tower	F.L. 2600 m.	Paris	Stock Exchange, closing prices (Saturdays excepted).	8 minutes.
4.30	Voxhaus	——430 m.	Berlin	Light Orchestra, followed occasionally by Sporting News.	Until 6 p.m.
4.50	Haeren	B.A.V. 1100 m.	Brussels	Weather Forecast	5 minutes.
5.00	Radio–Belgique	S.B.R. 265 m.	Brussels	Concert, followed by News Bulletin	6 p.m.
5.30	Munich	——486 m.	Bavaria	Light Orchestra	Until 6.30 p.m.
5.30	Ravag	——530 m.	Vienna	Concert	Until 7 p.m.
7.00	Voxhaus	——430 & 500 m.	Berlin	Lecture	45 minutes.
7.00	Eiffel Tower	F.L. 2600 m.	Paris	General Weather Forecast	8 minutes.
7.00	Munster	——407 m.	Westphalia	Concert	Until 8.30 p.m.
7.00	Konigsberg	——460 m.	East Prussia	Concert	Until 8.30 p.m.
7.15	Radio–Belgique	S.B.R. 265 m.	Brussels	Concert, followed and preceded by News Bulletin	Until 9.10 p.m.
7.15	Leipzig	——452 m.	Leipzig	Concert, followed by News	8.35 p.m.
7.15	Ecole. Sup. des Postes et Telegraphes.	P.T.T. 450 m.	Paris	Lecture, followed by Concert (Usually Outside Broadcast, sometimes begins at 7 or 7.30 (Mondays excepted.)	Two to three hours.
7.15	Lausanne	H.B.2 850 m.	Switzerland	Concert (Thursdays excepted)	8.30 p.m.
7.30	Frankfurt	——467 m.	Frankfurt	Concert followed by News	Between 9 and 10 p.m.
7.30	Stuttgart	——437 m.	Wurtemburg	Concert followed by News	Until 8.30 p.m.
7.30	Breslau	——415 m.	Silesia	Concert	Until 10 p.m.
7.30	Hamburg	——392 m.	Germany	Concert	Until 10 p.m.
7.30	Leipzig	——452 m.	Germany	Concert, Short News; Bulletin at 8.45 p.m.	Until 10 p.m.
7.30	Zurich	——650 m.	Switzerland	Concert followed by News	9.15 p.m.
7.30	Voxhaus	——430 & 500 m.	Berlin	Concert followed by Weather Report	Until 9.15 p.m.
8.00	Munich	——486 m.	Bavaria	Music and Speech, followed by News	9 p.m.
8.30	Radio–Paris	S.F.R. 1780 m.	Clichy	General News Bulletin	One half-hour.
9.00	Radio–Paris	S.F.R. 1780 m.	Clichy	Time Signal in Greenwich Time, followed by Concert	9.50 p.m.
9.30	Radio Iberica	——392 m.	Madrid	Concert	Until midnight.
10.00	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark).	5 minutes.
10.10	Eiffel Tower	F.L. 2600 m.	Paris	Weather Forecast	5 minutes.
10.44	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 minutes.
11.57	Nauen	P.O.Z. 3100 m.	Berlin	Time Signal in G.M.T. (Spark)	8 minutes.
		SUNDAYS.			
a.m.					
9.23	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 minutes.
9.50	Konigswusterhausen	——680 m.		Concert	1 hour.
10.00	Ravag	——530 m.	Vienna	Instrumental Concert	Until 11.30 a.m.
10.00	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark).	5 minutes.
10.30	Lyons	Y.N. 470 m.	Lyons	Concert	Until 10 p.m.
10.44	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 minutes.
10.50	Konigswusterhausen	L.P. 2800 m.	Berlin	Concert	Until 11.45 a.m.
10.55	Eiffel Tower	F.L. 2600 m.	Paris	Fish Market quotations	5 minutes.
	Nauen	P.O.Z. 3100 m.	Berlin	Time Signal in G.M.T. (Spark)	8 minutes.
11.57	Nauen	P.O.Z. 2800 m.	Berlin	Time Signal in G.M.T. (Spark)	3 minutes.
p.m.					
12.45	Radio–Paris	S.F.R. 1780 m.	Clichy	Concert, followed by News	1.45 p.m.
1.40	Ned. Radio Industrie	P.C.G.G. 1050 m.	The Hague	Concert, followed by announcements in English.	Until 5.40 p.m.
4.45	Radio–Paris	S.F.R. 1780 m.	Clichy	Concert, followed by News	5.45 p.m.
5.00	Radio–Belgique	S.B.R.	Brussels	Concert	6 p.m.
5.30	Eiffel Tower	F.L. 2600 m.	Paris	News Bulletin	10 minutes.
5.30	Ravag	——530 m.	Vienna	Concert	Until 7p.m.
6.00	Voxhaus	——430 m.	Berlin	Children's Corner	30 minutes.

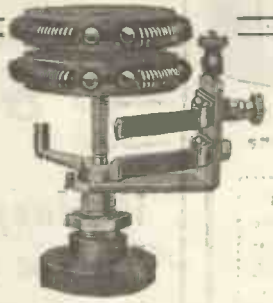
G.M.T.	Name of Station.	Call Sign and Wave Length	Locality where situated	Nature of Transmission.	Closing-down time or approx. duration of Transmission
p.m.					
7.00	Munster	——407 m.	Westphalia	Concert	Until 8.30 p.m.
7.00	Voxhaus	——430 & 500 m.	Berlin	Concert preceded by Religious or Patriotic Address	Until 9.15 p.m.
7.00	Konigsberg	——460 m.	East Prussia	Concert	Until 8.30 p.m.
7.00	Eiffel Tower	F.L. 2600 m.	Paris	General Weather Forecast	8 minutes.
7.30	Zurich	——650 m.	Switzerland	Concert, followed by Late News	9.15 p.m.
7.30	Breslau	——415 m.	Silesia	Concert	Until 10 p.m.
7.30	Hamburg	——392 m.	Germany	Concert	Until 10 p.m.
7.30	Leipzig	——452 m.	Germany	Concert, Short News Bulletin at 8.45 p.m.	Until 10 p.m.
7.30	Stuttgart	——437 m.	Wurtemburg	Concert, followed by Dance Music	Until 10.30 p.m
7.40	Ned. Seintoestellen Fabr.	N.S.F. 1050 m.	Hilversum	Concert	Until 10.10 p.m.
8.00	Radio-Paris	S.F.R. 1780 m.	Clichy	Concert, followed from 9 p.m. until 9.45 p.m. by Dance Music.	Until 9.45 p.m.
8.15	Radio-Belgique	S.B.R. 265 m.	Brussels	Concert, followed by News Bulletin	Until 10 p.m.
8.30	Radio-Paris	S.F.R. 1780 m.	Clichy	General News Bulletin	Until 9 p.m.
8.30	Ecole Sup. des Postes et Telegraphes.	P.T.T. 450 m.	Paris	Concert or Lecture. (May begin a quarter-hour earlier or later).	Ends between 10.30 and midnight.
9.30	Petit Parisien	——340 m.	Paris	Concert (Items announced in English as well as French).	Until 11.30 p.m.
9.30	Radio Iberica	——392 m.	Spain	Concert	Until 11.30 p.m.
10.00	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark).	5 minutes.
10.44	Eiffel Tower	F.L. 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 minutes.
11.57	Nauen	P.O.Z. 3100	Berlin	Time Signal in G.M.T. (Spark)	8 minutes.

SPECIAL DAYS.

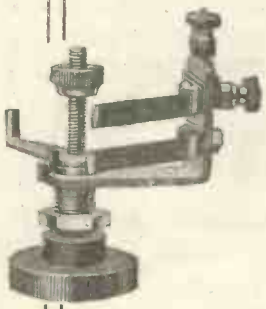
p.m.						
2.00	Ecole Sup. des Postes et Telegraphes	P.T.T. 450 m.	Paris	Fridays	Concert or Lecture	Two hours.
4.00	Lausanne	H.B2 850 m.	Switzerland	Thursdays	Children's Stories	One hour.
5.15	Eiffel Tower	F.L. 2600 m.	Paris	Mondays, Wednesdays Fridays.	Concert, followed by by News.	Until 6.10 p.m.
5.30	Eiffel Tower	F.L. 2600 m.	Paris	Tuesdays, Thursdays, Saturdays.	News Bulletin	10 minutes.
6.00	Voxhaus	——430 m.	Berlin	Wednesdays	Childrens' Corner	30 minutes.
6.55	Ned. Radio Industrie	P.C.G.G. 1070 m.	The Hague	Mondays	Children's Hour	Until 8.10 p.m.
7.00	Svenska	——470 m.	Stockholm	Tuesday & Thursday.	Concert	Until 10 p.m.
7.40	Heussen Laboratory	P.C.U.U. 1050 m.	The Hague	Tuesdays	Concert	Until 9.40 p.m.
7.40	Smith and Hooghoudt	P.A.5 1050 m.	Amsterdam	Wednesdays	Concert	Until 9.40 p.m.
8.10	Ned. Radio. Industrie	P.C.G.G. 1070 m.	The Hague	Mondays & Thursdays.	Concert	Until 10.10 p.m.
8.10	Middelraad	P.C.M.M. 1050 m.	Ymuiden	Saturdays	Concert	Until 9.40 p.m.
8.40	Ned. Seintoestellen Fabriek	N.S.F. 1050 m.	Hilversum	Fridays	Concert	Until 9.40 p.m.
9.00	Le Matin	S.F.R. 1780 m.	Paris	Every 2nd & 4th Saturday of the month	Special Gala Concert with leading Parisian artists.	Till 10.50 p.m.
9.30	Petit Parisien	——340 m.	Paris	Tuesdays & Thursdays	Concert (Items announced in English as well as French).	11.30 p.m.
10.00	Radio-Paris	S.F.R. 1780 m.	Clichy	Wednesdays & Fridays.	Dance Music	Until 10.45 p.m.

PRACTICAL POLAR ANSWERS to your call for better reception.

British Made and Guaranteed.



Write for Descriptive Lists.

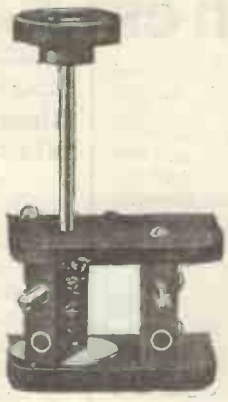


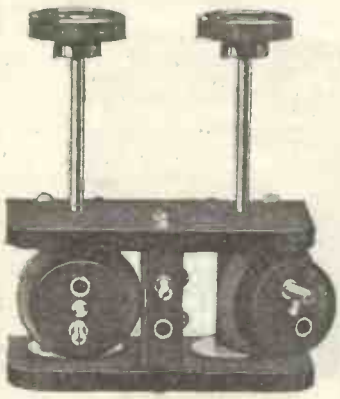
The NEW POLAR RHEOSTAT.

By means of an ingenious device this rheostat makes provision for a movable bobbin, which can be interchanged according to the resistance required as determined by the type of valves used.

Price complete ... **5/6**

See this at the R.C.C. Stand No. 61 at the N.A.R.M. Exhibition at the Albert Hall, or write for full explanatory leaflet.





Polar Precision Condenser.

Low minimum capacity allows a very wide range of extremely delicate adjustment.

An exactness of tuning hitherto unknown is possible with this robust guaranteed condenser.

Price for panel mounting **12/6**

Price for Mounted Type **18/-**

In the centre is the Polar Cam Vernier Junior coil holder designed to meet the requirements for cheaper models.

Price 2-Coil **6/-**

„ 3-Coil **9/6**

Write for explanatory leaflets.

Two New Polar Cam Vernier Coil Holders.

On the right is the new type of Polar Cam Vernier Coil Holder. This new design retains all the good features of the existing Cam Vernier coil holders in addition to which is incorporated an ingenious arrangement by means of which the coils rotate round their own axis as they move towards or away from the fixed coil. In this way they travel from a position of maximum inductance through a well graded descent to a position of absolute zero.

Price 2-Coil **11/-**

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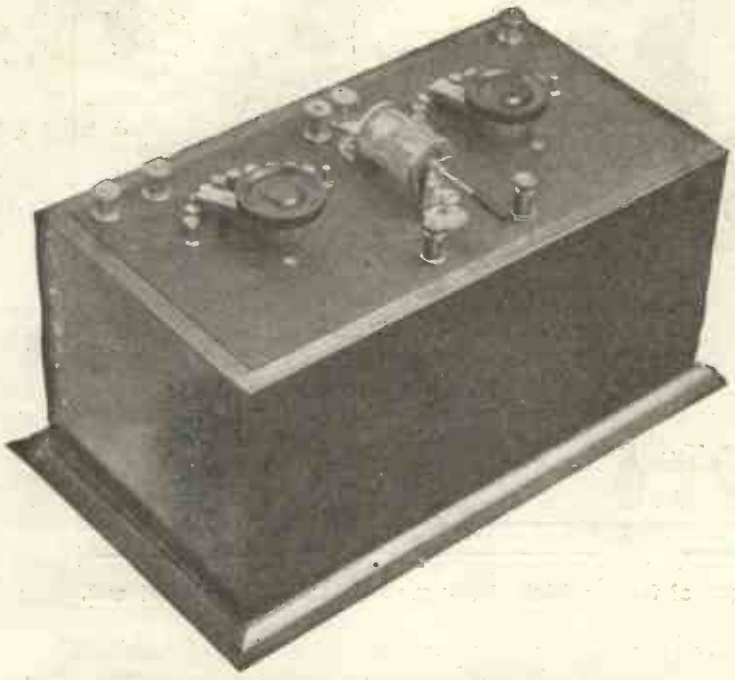


Fig. 1.—The photograph shows the neat lay-out and general appearance of the set.

A Tapped-Coil Crystal Set

By

WALTER STEVENS.

Many readers are anxious to make a crystal set which will receive Chelmsford without requiring a plug-in coil. This inexpensive receiver will give them what they need.

WHEN broadcasting first commenced practically every home-constructed crystal set employed as a tuner a large cylindrical coil of the slider type wound with enamelled copper wire. Such a set has two disadvantages. Apart from the possible injury to the insulation, the enamel covering of the wire, there is very little spacing between the adjacent turns on the coil, this leading to an increase in what is known as the self-capacity of the coil, which should always be avoided as far as possible, save where efficiency can be sacrificed in an ultra simple set. The greatest fault in this kind of coil, however, is the often very marked "dead-end effect" experienced when using only a small portion of the total inductance. Signals come in at very poor strength compared with the results obtainable on a smaller coil.

Dead-end Effects.

The writer was recently asked to examine a crystal set which gave very poor results at a distance of twelve miles from 2LO. The tuner consisted of a cylindrical former 3 in. in diameter and 12 in. long, wound nearly the whole of its length with 24 S.W.G. enamelled wire, tuning being carried out by means of a slider. 2LO was received at maximum strength with the slider ¾ in. from the end of the coil. By placing a finger on the dead end of the coil signal strength was nearly doubled, and became still louder on retuning slightly. A permanent effect was obtained by connecting the free end of the coil to the slider. Unfortunately this remedy is not efficacious in all cases, and it appears that the only really effective means of eliminating dead-end effect in a coil in which only a small percentage of the turns is in use is to have facilities for making a break in the coil at a point a little above the wavelength or waveband it is desired to cover.

Such an arrangement is provided in the set shown in Fig. 1, which is designed for the efficient reception of the high-power station at Chelmsford, and the usual broadcasting stations on the lower wavelengths.

Tuning is carried out by means of two switches, one working over ten studs, and the other over twelve. The tuning coil is thus tapped in twenty places, the two ends of the coil being connected to end studs on the switches.

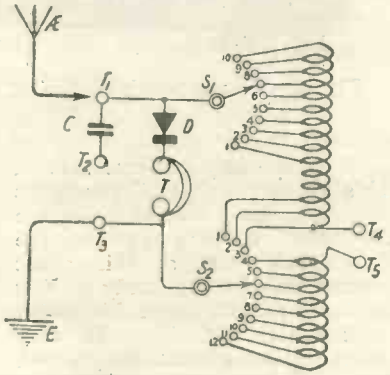


Fig. 2.—The theoretical circuit of the receiver.

The Circuit of the Receiver.

The circuit diagram is seen in Fig. 2. The aerial lead terminating in an arrow head indicates that it may be connected to either T_1 or T_2, across which is connected the fixed condenser C of 0.0005 μF capacity. D is the crystal detector, and T the telephones.

Coarse tuning is accomplished by means of the switch S_2, and fine adjustment by S_1. S_2 has twelve contact studs, the number of turns between the adjacent studs being ten in each case. The switch S_1 has ten studs, the tappings in this case being taken at every two turns of the coil. The terminals T_4 and T_5 are connected respectively to stud 3 of the switch S_2, and a point on the tuning coil; it is by means of these two terminals that the breaking of the coil winding, for reasons previously explained, is accomplished.

Components Required.

The following is a list of the components used in the construction of the receiver:—

Ebonite panel 10 in. by 5 in. by ¼ in.

Cabinet to take above panel.

5 P.O. type terminals.

2 telephone terminals.

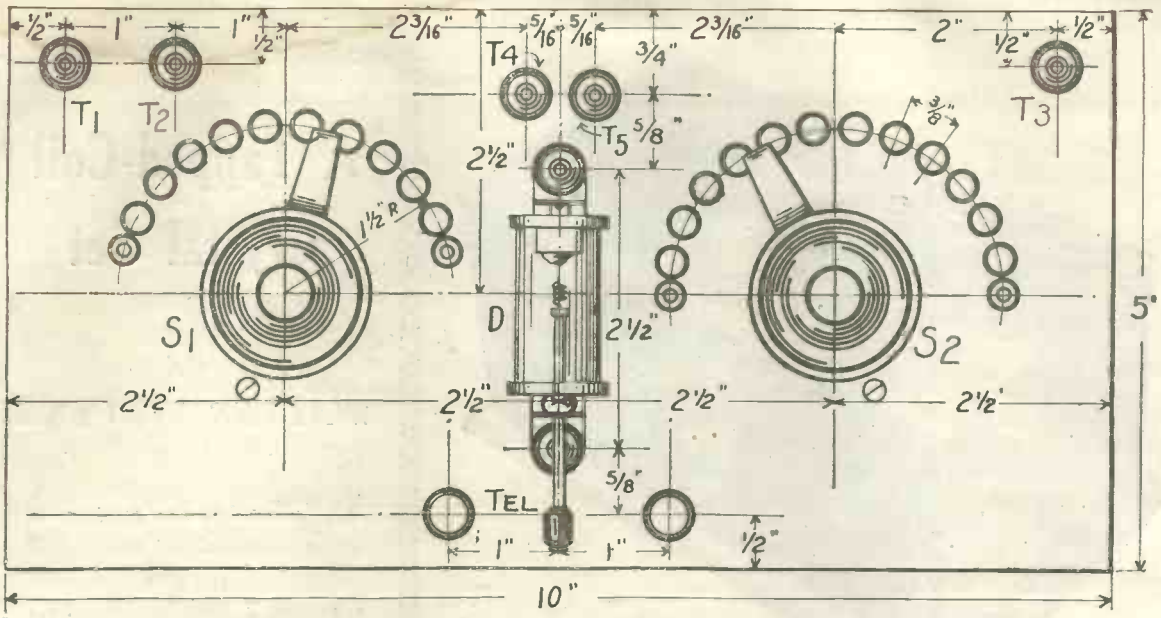


Fig. 3.—Dimensioned plan of the panel from which drilling may easily be carried out.

Crystal detector (enclosed type).
Impregnated cardboard tube, 6 in. long, 3 in. diameter.
1 0.0005 μF fixed condenser.
2 switch arms.
22 contact studs.
4 switch stops.
¼ lb. No. 24 D.C.C. wire.
4 yards rubber sleeving.
2 small pieces of wood 1¼ in. by ¾ in. by ⅜ in.
Short length of stiff copper wire.
Small screws.

The actual terminals and switches used were of the plated variety, as also was the crystal detector. The constructor, however, may naturally please himself on these points, as they do not affect the working of the set.

The Construction of the Coil.

This should not prove difficult if the illustrations and photographs are first studied carefully.

Fig. 5 shows the appearance of the inside of the completed coil, and an enlarged view of one tapping is given in Fig. 6. A view of the outside of the finished coil is seen in Fig. 8.

The first thing to do upon tackling the coil is to make twelve holes in the former, each ¼ in. from one end and ½ in. apart. Ten holes are made in the other end of the former, the same spacing and distance from the end being observed as in the case of the holes previously made. As the coil is to be screwed later to two pieces of wood, the holes at each end should be opposite each other.

The winding is commenced from the end of the tube in which the ten holes have been made, the end of the wire being secured by threading through one of the end holes from the outside, then over the end and through the same hole again, as in Fig. 5. The piece of wire thus left projecting into the former should be of ample length, say, 8 or 9 in., as it is to be connected later to the first stud of the switch S_1. The wire should now be wound away from the row of holes extending from one side of the starting point, until two turns minus ½ in. have been wound. We are now exactly opposite the second hole, and at this point another hole is made, firmly holding the turns of wire meanwhile, with finger and thumb. Form the wire into a loop about 6 in. long, thread it through the hole made for it, and draw it tight. Now bring the loop outside the tube and thread it through the second hole so that it passes, as it were, through itself. Fig. 6 will make this point quite clear. We now proceed to wind another two turns minus ½ in., the tapping being made in precisely the same manner as previously. The turns should be kept close together.

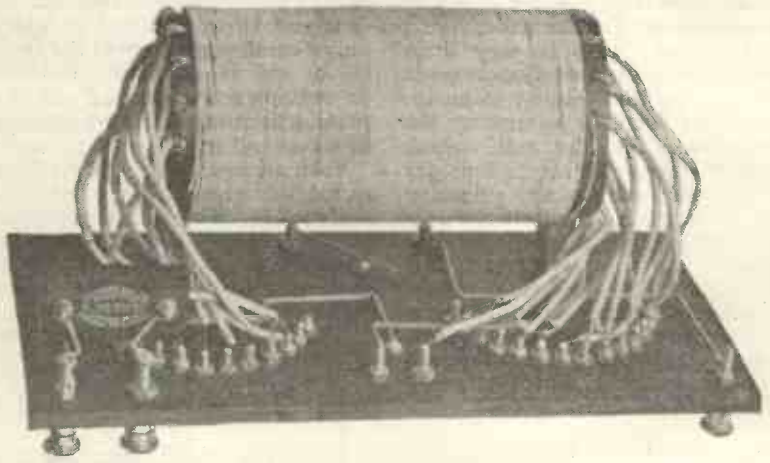


Fig. 4.—Photograph showing underneath view of the panel.

Having made the ten tappings at every two turns (the end of the coil being counted as one tapping), thirty turns are wound on continuously. On the thirtieth turn a hole is made in the former at the point opposite the first hole in the unwound end. If the directions given have been carried out accurately, this point should correspond roughly with the point

A Five-Guinea Loud Speaker Receiver!

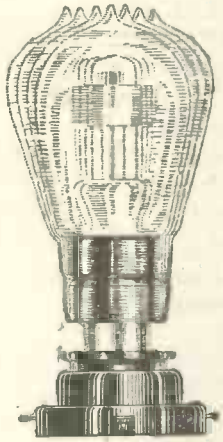
The Ethophone-Duplex is built in a one-piece matt-surfaced case moulded of an insulating compound having the appearance and properties of ebonite.

The Ethophone-Duplex

THE Ethophone-Duplex is intended expressly for listeners who want an efficient loud speaker receiver at moderate cost. Reception of broadcast about 20 miles from a normal power station and about 100 miles from the high power station on a loud speaker may be expected under favourable conditions. The range on head telephones may be four or five times as great. Dull-emitter or bright valves may be used without alteration to the set. The first valve acts as a radio frequency amplifier as well as a detector. Tuning is effected by two controls and the wave-length range extends from 250 metres upwards.

The low price of the Ethophone-Duplex is due to mass production methods. The instrument is fully up to the usual high standard of Burndept Apparatus. At five guineas you will not get a better receiver. Write for full particulars.

No. **1503**. Ethophone Duplex, without valves, batteries, coils, etc., with full instructions, **£5 5 0**. To which must be added, **£1 5 0** Marconi Licence.



This illustration shows what happens when you tap the valve. Ordinarily, four springs in the base of the Anti-Phonic Holder absorb mechanical shocks, so protecting the filament of the valve.

The Anti-Phonic Valve Holder

John Scott-Taggart, F.Inst.P., A.M.I.E.E., writes in the "Wireless Weekly," dated Sept. 10: "I consider this new component as an example of enterprise which is curiously lacking in the industry to-day."

WHATEVER valves you use, the Anti-Phonic Valve holder will tend to preserve their life by relieving the filament from all shocks. Read this extract from a lecture delivered at the Institute of Electrical Engineers:—

"Very numerous experiments in connection with the microphonic noise characteristic of dull-emitter valves have driven us to the conclusion that the effect is entirely due to the filament retaining a high degree of elasticity at its normal operating temperature. At present the only practicable method of eliminating these noises seems to be to mount the valve on a special type of holder designed to prevent any except very low frequency vibrations from reaching the valve."

The Anti-Phonic Valve Holder prevents vibrations of a frequency of eight per second—too low to be heard. No rubber is used.

No. **401**. Anti-Phonic Valve Holder. Diameter 2⅜ ins., height just over 1 in. For panel or base mounting. In carton with screws, 6 -.

Purchase Burndept by its name—substitutes are not the same.

WE are exhibiting at the All-British Wireless Exhibition, Albert Hall, September 27th, October 8th, Stands 72 and 74, and Boxes 134 and 135. Displays of our new apparatus are also being held at our Provincial Branches and by our Principal Agents.

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at which the last tapping was made.

A tapping is made at this point in exactly the same manner as those previously made, except that in this case, and in the case

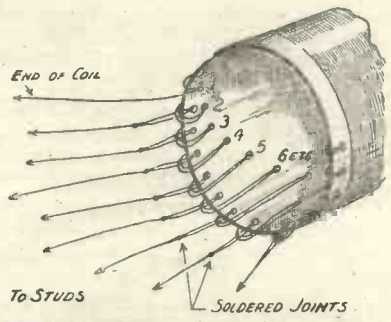


Fig. 5.—The inside of the coil. Notice how the tappings are brought out.

of the tappings which follow, the loop is made longer in order to ensure that a long enough lead to reach the correct stud is available. Ten turns are now wound on, *plus* ½ in., and the hole for the tapping made at this point.

When eleven tappings have been taken in this way, another ten turns are wound, after which the coil is ended by cutting the wire and fixing it by means of the last hole. This comprises the twelfth tapping.

Soldering the tappings.

We now have twenty loops projecting from the ends of the coil, and each of these is converted to a single wire of greater length. The method of doing this is to cut one of the wires comprising the loop at about 1 in. from the point where it enters the cardboard tube. Two separate leads of different length are thus formed. The smaller one has some of the cotton covering scraped from it, leaving about ½ in. of the wire bare. Part of the longer wire is treated in the same manner at a place corresponding to the bare portion of the shorter wire, and the two wires soldered together. The loops treated thus should appear as in Fig. 5. One loop, however, is treated differently. Instead of

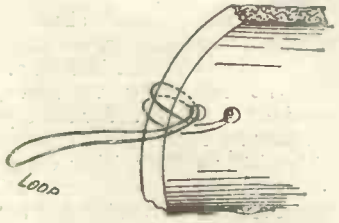


Fig. 6.—The method of securing the tappings can be clearly seen in this diagram.

being cut near the former, the break is made at the extreme end of the loop. The loop referred to is the third of the ten-turn tappings, or the tenth from the end of the

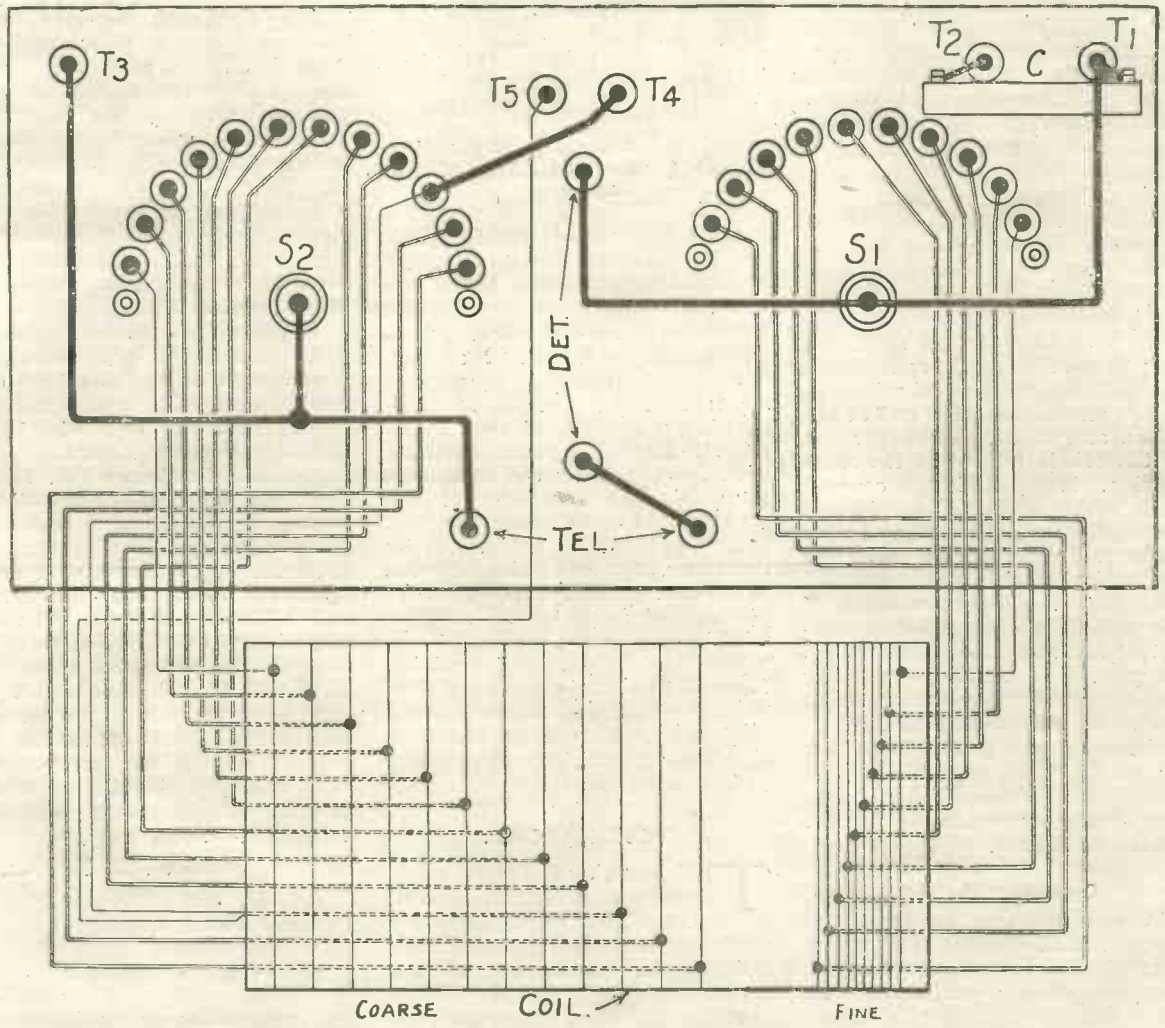


Fig. 7.—From this diagram of the wiring the connections of the tappings to the switches will easily be followed.

coil from which the coarse tappings are taken, counting the end of the coil as the first tapping. The coil may be left at this stage, and the assembly of the other components on the ebonite panel carried out.

Assembling and Wiring.

The components should be mounted according to the diagram of the panel layout in Fig. 3. It may be necessary to find the positions of the holes for the crystal detector by trial.

Turning to the wiring diagram, Fig. 7, the stiff wire connections shown should be carried out before mounting the coil, which is seen removed from the panel for the sake of clearness. The right-angle leads from the coil are drawn thus for the same reason. The fixed condenser C is kept in position by the stiff wires connecting it to T_1 and T_2.

The coil is mounted at this stage by means of the two pieces of wood mentioned in the list of components, these being screwed to the back of the panel by means of wood screws, the approximate positions for which are seen a little below the switch knobs, Fig. 3. The ends of the coil are screwed to the wooden blocks at points where no wires are in the way, and, of course, the correct way round.

Now, commencing with the end from which the first tappings were taken, each wire is bent to assume the position it will have to take when connected to its stud, the surplus cut off, and the end bared; the first tapping (end of coil) goes to the stud nearest the end of the panel, and so on. The other end of the coil is treated in the same fashion. Each lead is now covered with rubber sleeving, and joined, preferably by means of solder, to its correct stud. Fig. 7 will clear any difficulty with regard to these connections. The connections of the special tapping previously mentioned are also made clear in this diagram. It should be specially noted, however, that the fine tuning side of the coil is connected to T_4 and stud 3 of S_2, and the other side to T_5. This done, the set is complete, the cabinet being bought ready-made, or constructed by the reader, as desired.

Operating the Set.

When it is desired to tune in one of the B.B.C. stations working on one of the usual wavelengths, between 300 and 500 metres, the aerial should be taken to T_1, the earth lead from T_3, and T_4 and T_5 left open.

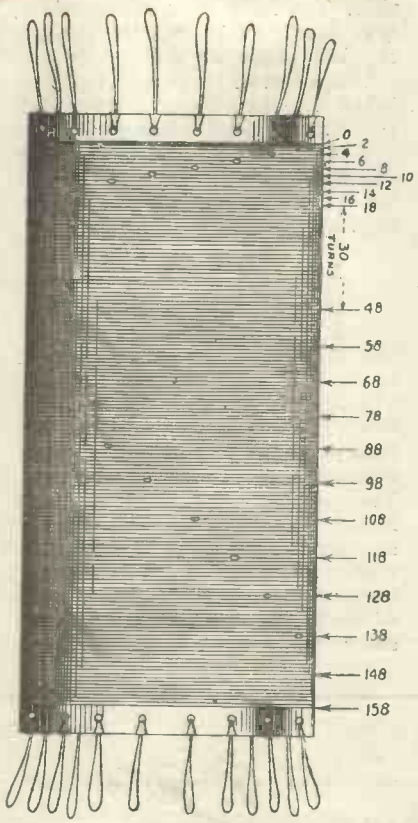


Fig. 8.—A view of the coil showing the positions of the tappings.

No matter what wavelength is required, the best method of tuning is to place the switch S_2 on one stud, and slowly rotate the other switch over all its studs. If no signals are heard, the next stud on S_2 should be tried, with a consequent rotation of S_1, and so on until signals are received at their maximum strength. When listening with the set under the conditions given for the reception of the lower wavelengths, only the first three studs of S_2 are usable or necessary, the rest being cut out of circuit. The experiment of joining the aerial to T_2 may be tried.

The best method of receiving Chelmsford is to join the aerial to T_1, T_2 to T_3, and T_4 to T_5, the earth connection being taken to T_3. Tuning is carried out according to previous instructions.

TEST REPORT.

THE following tests were made upon a twin aerial 70 ft. long and 45 ft. high, the earth connection being immediately beneath the lead-in end of the aerial.

With the aerial connected to T_1, earth to T_3, and T_4 and T_5 open, 2LO was received with the switch S_1 on the sixth stud, and S_2 on the first. On joining the aerial to T_2, thus placing the 0.0005 μF condenser in series, 2LO was received at maximum strength with S_1 on stud 8, and S_2 on stud 2.

5XX was received by joining the aerial to T_1, T_2 to T_3 (which places the 0.0005 μF condenser in parallel with the coil), and T_4 to T_5, the earth being connected to T_3. S_1 was on the fourth stud, and S_2 on the eleventh. Telegraph stations on the French coast were received on six hundred metres by connecting the aerial to T_1, T_4 to T_5, and T_3 *to earth*.

On a normal aerial thirteen miles from 2LO and nineteen miles from 5XX, each of these stations were received at good strength, especially so in the case of the latter station.

ADVERTISERS PLEASE NOTE

To the Editor of MODERN WIRELESS.

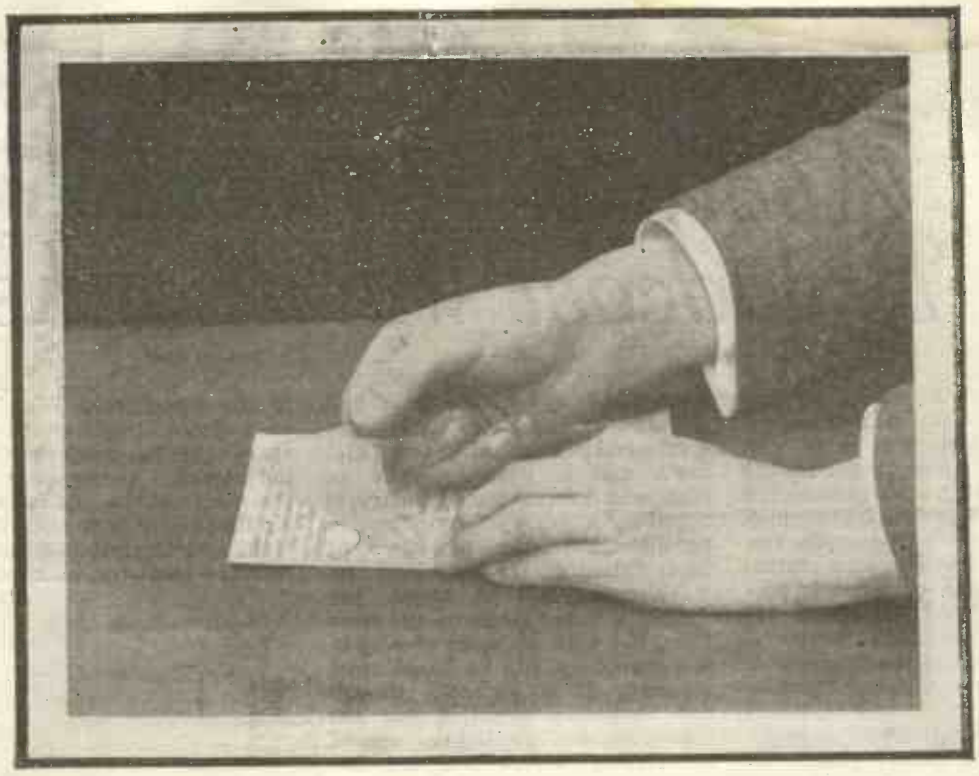
SIR,—I recently received from home a copy of your splendid paper MODERN WIRELESS. I was very pleased with it. I thought perhaps you would like these few lines from one who is at present in the great lonely out-back of the West Australian bush and therefore far removed from the pleasure of listening in each evening. You are no doubt aware that there is a broadcasting station in Perth recently opened.

At present out here all wireless parts are a fearful price and there is not much on the market. On looking through MODERN WIRELESS I only note one firm who have agents in Western Australia, that of "Fallon Condenser Co., Ltd." Could you inform me of any others having agents in this country? It may be possible for you to get some of the firms who have agents out here to include the name and address of same in their advertisements. I think there is and will be plenty of trade for them and it will save a lot of time if we are able to buy decent stuff here instead of having to send to England for components and wait two months for them. Wishing all success to MODERN WIRELESS.—Yours truly,

W. H. TAYLOR.

C/o J. H. McCarthy,
Billair Farm, Kilitrup,
Via Kojonup.
Western Australia.

[EDITORIAL NOTE.—Firms interested are invited to get into touch with our correspondent.]



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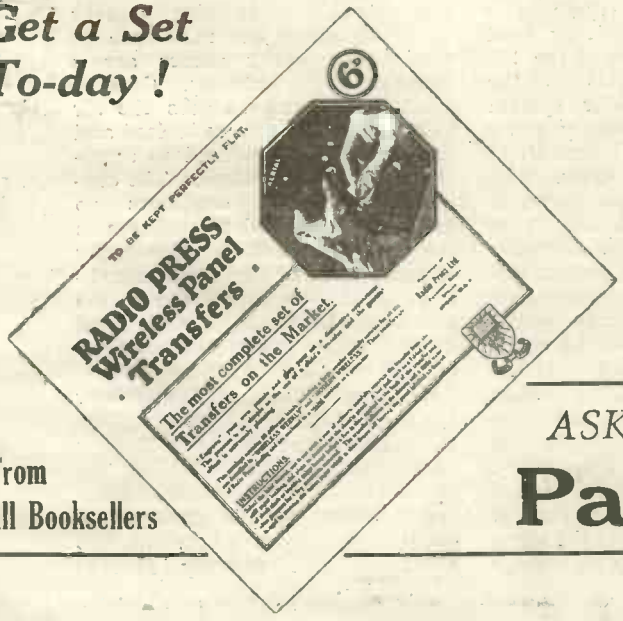

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Above & below the Broadcast Wavelengths

IF you have happened to tune down to the neighbourhood of 75 metres recently you will no doubt have picked up the short wave transmissions from the big German station at Nauen which is to be heard working pretty frequently with the Brazilian station at Buenos Aires, on what is probably the shortest wavelength yet used for commercial purposes. What the input of the transmitter is I do not know, but it must be something very big indeed, for in any part of this country a single valve set will bring it in with enormous strength. It is, in fact, not even necessary to heterodyne the signals in spite of the fact that they are, of course, continuous wave. With one valve without any kind of reaction it is possible to read the signals quite easily simply by the key clicks. One can do much the same thing if one is quite close to any large C.W. station, but I have never before come across a case where heterodyning could be dispensed with at such very long range. If you have not yet heard POZ it is well worth while to do so, and as the simplest form of receiver will do all that is necessary no difficulty at all will be found in getting down to the required 75 metres. A suitable home-made

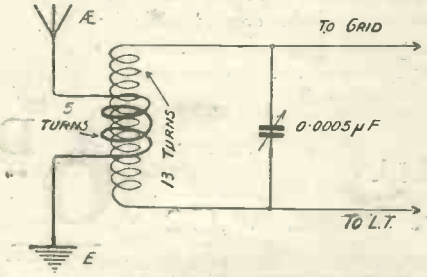

Fig. 1.—An efficient short-wave tuner for 75 metres.

tuner consists, as shown in Fig. 1, of 13 turns of No. 16 double cotton covered wire wound on a 3½ inch former. The turns should be spaced a little if possible. Over them and in the middle are wound 5 turns of the same wire. The 5 turn coil is attached to aerial and earth and is untuned. The 13 turn, which forms the secondary, is tuned by a .0005 μF condenser in parallel. For the reception of trans-Atlantic transmissions on wavelengths up to about 120 metres a tuner made on the same lines, but with 16 turns of wire in the secondary, will be found most efficient. It is desirable, though not absolutely essential, that the turns should be slightly spaced when they are wound on. No shellac should be used.

Transmitting Methods

It may be of some interest to take a glance at the different methods of transmission used by the great stations, with which all of those whose wireless reception is not limited to broadcasting are familiar. It will come possibly as a surprise to many to know that there are four main systems of transmission in use at the present time. Most people if asked how many kinds of transmission there were would reply at once spark, arc and valve. But there is a fourth, which is extensively used in America and in some of the big European stations. This is the high-frequency alternator system developed independently by Alexanderson and Goldschmidt, to which we will refer later. The spark method of transmission is now regarded as at any rate obsolescent. It is the simplest of all, but it is the most uneconomical for anything like long-distance work owing to the large power required in order to set up oscillations of great amplitude. It has also the drawback that it cannot be sharply tuned, and therefore occupies not one wavelength but a fairly wide band of frequencies. A very simple form of spark transmitter is shown in Fig. 2. Here the oscillations from the alternator A are stepped up in voltage in the transformer T and passed to a closed circuit containing the spark gap, a condenser and an inductance. As the space between the points of the gap is filled with air its resistance is normally very high, and it therefore acts as an effective insulator, with the result

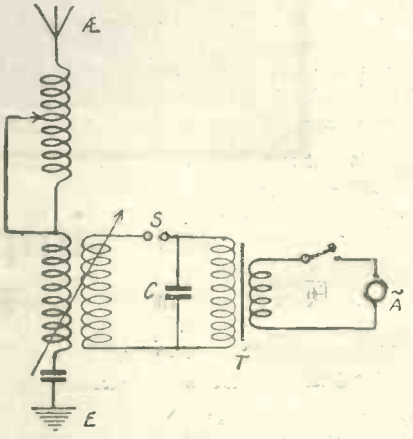

Fig. 2.—A circuit diagram of a simple spark transmitter.

that the condenser C is charged up to a high potential. As soon as this potential is sufficiently great to break down the resistance of the gap a spark passes across between the electrodes. Once a spark has begun to pass the air between them becomes ionised and its resistance is reduced to something very small indeed. The condenser therefore continues to discharge itself and to recharge in the opposite direction in a series of oscillations of decreasing amplitude, which are transferred to the aerial in the form of a damped wave. When the discharge is nearly complete sparking ceases. This simple form of transmitter has a great many bad points. The most important of these is that unless some means of cooling the gap is provided the circuit remains closed owing to the presence of conducting vapour between the electrodes and actually absorbs

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PURITY FIRST—VOLUME AFTERWARDS. All too readily moderate tone quality has been accepted as good, but sooner or later the right means of obtaining pure low frequency amplification will be used universally, instead of by those who are sufficiently discriminating, as at present.

The right way to obtain pure low frequency amplification is to use a coupling at each stage which has been designed to meet the technical requirements of the position. For instance, the importance of the first stage transformer cannot be over-estimated, for any distortion here is magnified many times with each succeeding stage. But the expensive transformer which is ideal for the first stage need not be used throughout unless superlative amplification is desired, for it is not so necessary to have such high impedance in the second and third stage transformers as in the one used for the first stage. Where power amplification is used, however, the first stage transformer should be employed.

Apart from the usual transformer coupling, another interesting coupling to use is the **LISSEN L.F. CHOKE COUPLING.** To the keen enthusiast the comparisons possible are very instructive. One can, for instance, see how many stages of **LISSEN CHOKES** can be used in cascade.

Each requirement of low frequency amplification is met by the following parts. In the design of these couplings, **PURITY OF TONE QUALITY HAS BEEN THE FIRST CONSIDERATION—PLEASING VOLUME THERE IS, TOO, BUT AFTERWARDS. IN BUYING A LISSEN TRANSFORMER OF ANY TYPE, YOU CAN BE SURE YOU ARE GETTING PURITY AND POWER—** and the best transformer value.

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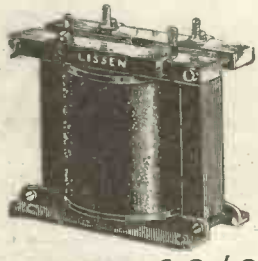

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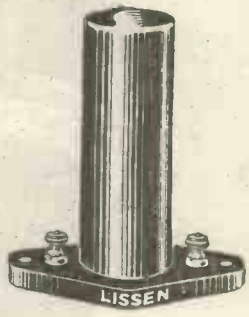

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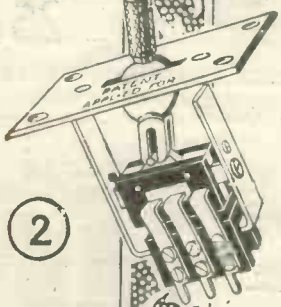

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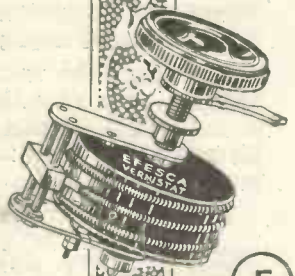

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(3) **EFESCA VARIABLE REACTION COIL.**—For use in either Aerial or Anode Circuits. Wound on ebonite former, totally enclosed, complete as illustration, **17/6.**

(4) **EFESCA TAPPED HIGH-FREQUENCY REACTANCE,** for one-stage of high-frequency amplification. It is self-tuned and requires no condenser. Wavelength range, 150–2,600 metres. Complete, as illustration, **21/-** each, or embodying grid-leak and condenser (.0003 mfd.), **25/-** each.

(5) **EFESCA VERNISTAT** (Patent applied for).—Of unique construction the Vernistat gives extremely delicate control and is smooth and silent in operation and is specially suited to high-frequency and Detector Valve filament control. Resistance 5 ohms, **6/-** each, complete, as illustrated.

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Here are two new lines of great interest.

The **"PURAVOX" LOUD SPEAKER.** The principle employed enables speech and music to be reproduced with quite exceptional purity and maximum volume. The "PURAVOX" Standard Table Model is a full size Speaker at a medium price. The "PURAVOX" Junior is suitable for smaller rooms. 2,000 ohms resistance, **£4 10 0** each. Junior model **£2 10 0** each.

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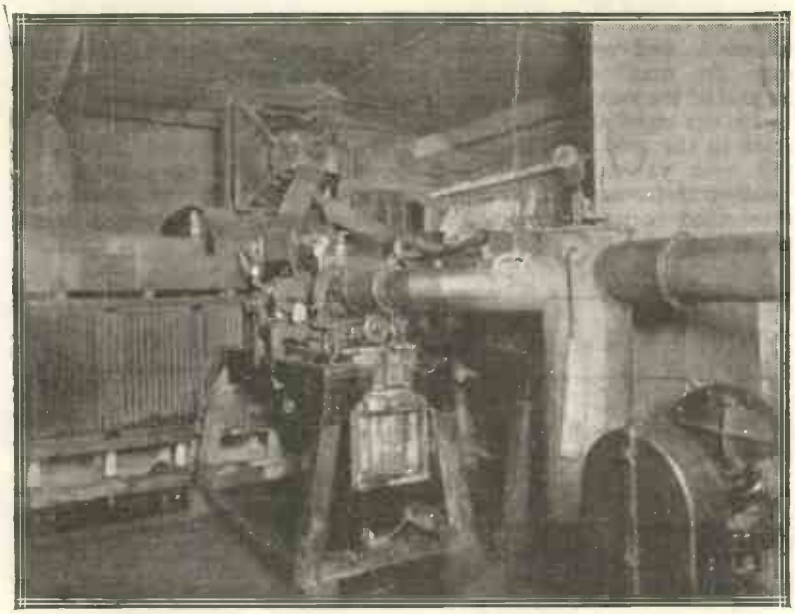
energy from the aerial. Various methods of quenching, that is of re-establishing the high resistance between the points of the spark gap before the condenser discharges have fallen to something very small, have been designed. In some cases a blower is used by means of which compressed air is forced between the electrodes to cool them. Another system makes use of a rotary spark gap in which a toothed wheel revolves at high



Part of the spark installation at the Eiffel Tower station.

speed between the electrodes, its revolutions bearing no relation to those of the alternator. A glance at Fig. 3, will show that when the wheel is in the position shown in the drawing two spark gaps are provided at the points A and B. At the next instant the gaps are broken, to be made again when the next pair of teeth come opposite the points. This system has the advantage of extinguishing the arc owing to the draught of air caused by the wheel. It does not, however, put out the spark sufficiently quickly to produce effective quenching. This system is known as the Asynchronous rotary gap. An improvement is the Marconi Synchronous spark gap which is shown in a simplified form in Fig. 4. Here the toothed wheel is attached to the shaft of the generator, and the teeth are of the same number as the poles of the generator. A spark is thus produced at each half cycle of the generator. This system has the advantage of producing a pure note. There is no arcing, but quenching is not so perfect as could be desired. The Telefunken Quenched Gap method is used by large numbers of German shore stations and ships. Here instead of one spark gap, as in the simplest system, or two as in the Synchronous and Asynchronous transmitters, we have a number of small gaps in series. The sparks take place between metal plates of comparatively large area, but with very small spaces between them. Owing to the large surfaces provided heat is radiated away rapidly. The rapid quenching of the spark in the closed arc leaves the aerial free to oscillate by itself and a purer wave is emitted.

The Poulsen Arc

The earliest system of continuous wave transmission brought into general use was that which makes use of certain curious properties of the electric arc. If we supply a high voltage direct current to two electrodes, a copper positive and a carbon negative, an arc may be struck by bringing them together, and maintained when they are separated at suitable distances from one another. Once formed the arc will continue owing to the conductivity of the hot gas between the electrodes, unless the points are moved so far away that the energy supplied by the dynamo is insufficient to compensate for that which is radiated away in the form of heat. Now in this arc the resistance is unstable. If we increase the current the resistance will fall off, from which it follows that the voltage drop between the electrodes will be reduced. Now take a circuit such as that shown in Fig. 5, consisting of a generator G, supplying current through the choke coils to the arc A, an inductance L and a condenser C. When the arc is struck the potential across its electrodes causes a current to flow into the condenser C, which is charged up. This current is drawn from the arc itself. The result of reducing the current in the arc is to increase the difference in potential across it, which still further charges the condenser. Owing to the presence of the inductance the voltage in the condenser rises until it is higher than that across the arc, and the condenser begins to discharge again, supplying the current to the arc and so reducing the voltage drop across it, which assists the process of discharge. When the discharge is complete the effect of the inductance is to charge the condenser again the opposite way. The current in the circuit is thus a continuous one with oscillations of equal amplitude so long as arcing persists. By enclosing the arc in a chamber containing a hydrogen or a hydro-carbon atmosphere, and by placing the arc in a strong magnetic field, it is possible to bring the frequency of oscillation up to radio-frequencies. Continuous waves generated in this way can be transferred to the aerial and radiated. Signalling with the arc method is usually done by the system known as "Marking and Spacing." When the tapping key is depressed it short-circuits a small portion of the aerial loading coil, thus altering the wavelength. Hence, dots and dashes are sent out on one

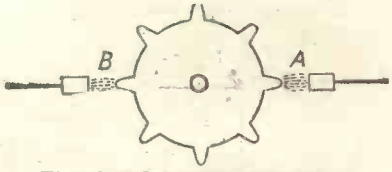


Fig. 3.—An Asynchronous rotary spark gap.

frequency, whilst the spacing wave has a different frequency. The other signalling system with arc circuits is known as the absorption method. This makes use of an oscillatory circuit, which absorbs the spacing wave, preventing it from being radiated at all. The arc system is in use in quite a number of big stations. Both Leafield and Northolt were designed originally as arc stations, but it was decided some time ago to convert them for valve transmission. One of the greatest dis-

(*Continued on page* 577).

Multi-Stage High-Frequency Amplification.

By JOHN SCOTT-TAGGART, A.M.I.E.E.

A continuation of the series of articles on a subject of vital interest to every experimenter desirous of increasing the range of his receiver.

LOOKING at Fig. 31 it will be seen that a middle tapping is taken from S to the filament of the valve. Under these conditions the end E_1 will always be at opposite potential to the end E_2 with respect to the filament. The oscillating potentials across $L_2 C_3$ will be communicated through the grid to anode capacity of the valve to the end E_1, but the same potentials are fed into the grid oscillatory circuit at the opposite end E_2, and these two coupling effects will consequently cancel each other out in their effect on the grid circuit.

Fig. 32 shows an arrangement which A. D. Cowper has proposed for neutralising the capacity inside the valve. The ordinary tuned anode arrangement $L_2 C_3$ is employed, and the potentials across this coil are used for communicating to the grid of the next valve. To the coil L_2, however, is coupled another inductance coil L_3, and this coupling effects a reversal of phase which enables us to apply, through the condenser C_2 to the grid, potentials of opposite sign to those which are being communicated to the grid through the grid to anode capacity of the valve.

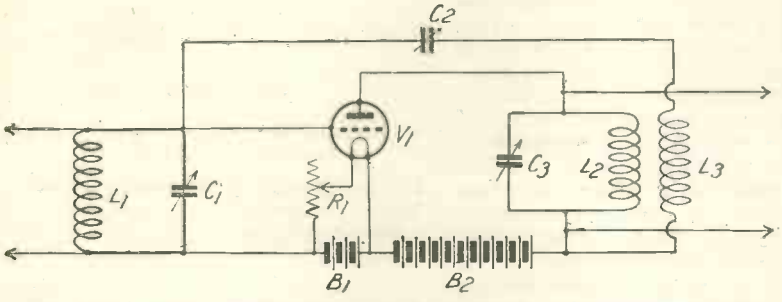


Fig. 32.—The neutrodyne arrangement suggested by Mr. A. D. Cowper.

Instead of using tuned anode coupling, as in Fig. 32, the secondary of the transformer which effects a reversal of phase may be connected to the grid of the following valve. Such a circuit is shown in Fig. 33, where a tapping is taken on the inductance L_3 and connection made through the small condenser C_2 to the grid of the valve. The arrow heads on the right show the connections to the grid and filament of the next valve. The high-frequency transformer $L_2 L_3$ serves as a coupling between the anode circuit of the valve shown and the succeeding valve, but at the same time by the transformer arrangement it is possible to obtain a reversal of phase so that potentials will be passed through C_2 to the grid, of opposite sign to those which are passed to the grid through the various undesirable capacities.

The dotted line in Fig. 33 indicates that the bottom of the coil L_3 is really connected to the filament of the first valve, because in a multi-valve set working with a single accumulator, the lower arrow head on the right-hand side of Fig. 33 would go to the common filament battery.

Actual Circuits Embodying the Methods Described

It is now proposed to give typical examples of multi-stage amplifiers in which the principles already outlined are carried into effect.

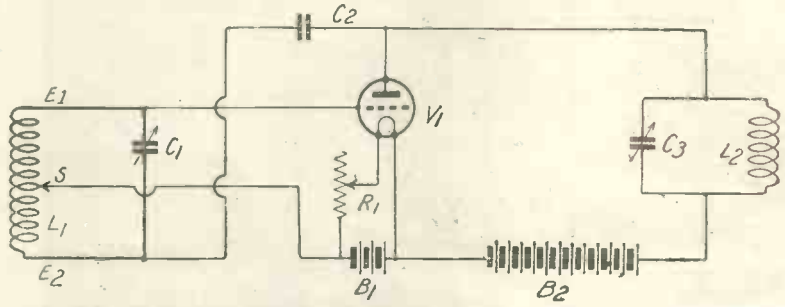


Fig. 31.—A circuit in which valve capacity is neutralised by a tap on the grid circuit.

The first of the circuits shown is that illustrated in Fig. 34, and here we have two tuned anode circuits. In this arrangement self-oscillation is very prevalent, although only two stages of high-frequency amplification are shown. It will be seen that the most stable form of aerial coupling is illustrated, and that the earth side of the aerial circuit is connected to the positive terminal of the filament accumulator, thereby introducing a large amount of damping into the grid circuit of the first valve. This will help greatly to stabilise the first valve, but the second valve is more likely to give trouble. This second valve has for its grid circuit the tuned anode circuit of the first valve, and its anode circuit, of course, is tuned, as shown. The anode current flowing in the anode circuit of the first valve will help to introduce damping into the circuit $L_2 C_2$, and it is therefore undesirable that the filament of the first valve should be turned too low. This may help to stabilise the first valve, but it will help to create instability in the second valve. The grid of

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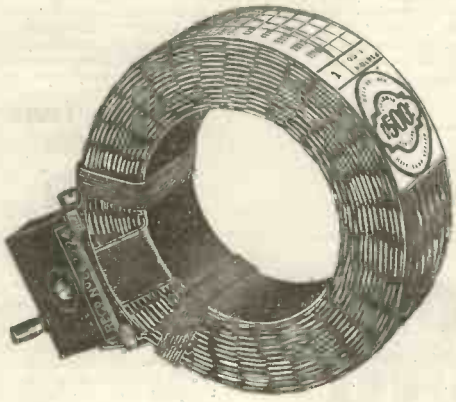

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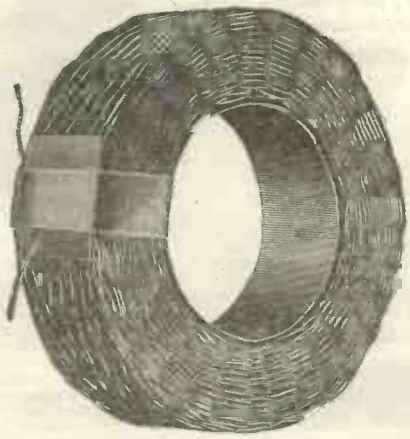

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the second valve is connected through the gridleak R_4 to the positive terminal of the accumulator for the purpose of introducing damping into the circuit L_2 C_2, but this will cause the second valve to rectify, although this is no very serious disadvantage.

The last valve, of course, is intended to rectify, and the bottom of R_5 is connected to the positive side of the accumulator B_1. This will help to introduce damping into the circuit L_3 C_3.

All the coils should be spaced well apart with a view to eliminating any inductive coupling between the coils, and also to reduce the capacity coupling between the coils.

If there is instability when the circuit is connected up, self-oscillation may usually be prevented by having larger condensers across the tuned anode circuits and using smaller inductances. Another precaution is to make the resistances R_4 and R_5 of lower value than usual, the experiment first being tried with the resistance R_4, which may be reduced to about 200,000 ohms, or even 100,000 ohms.

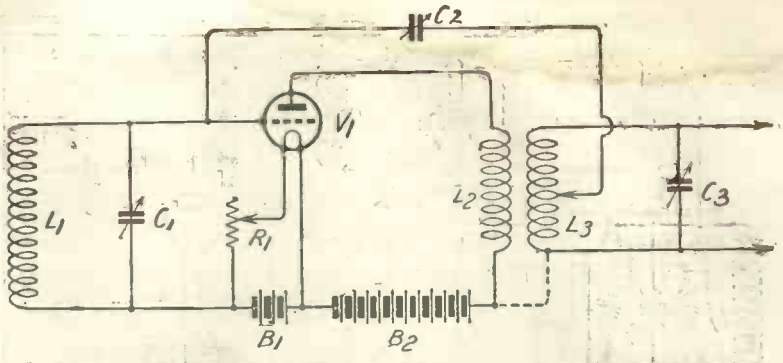

Fig. 33.—A circuit in which the tapping is taken from the grid circuit of the next valve.

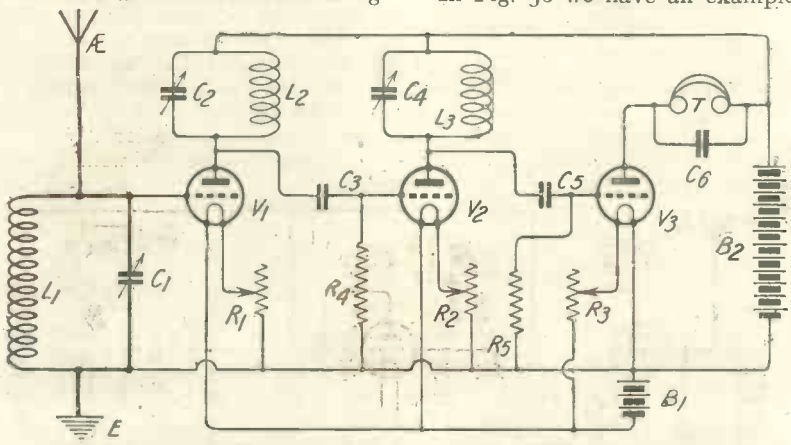

Fig. 34.—A two tuned anode circuit which has a pronounced tendency to fall into self-oscillation.

Use of Parallel Damping Resistances

In Fig. 35 is shown a method which has been specially favoured by myself in experiments in tuned anode coupling. It will be seen that there is a variable 100,000 ohm resistance across the grid circuit of the first valve, the anode circuit of the first valve, and the anode circuit of the second valve. These resistances should be capable of adjustment to infinity so that it can be seen which, if any, of the resistances are required to stabilise the circuit. It may be that only the resistance R_7 is required, in which case R_4 and R_8 may be put at infinity. It will, of course, be appreciated that a certain amount of reaction effect is desirable in high-frequency amplification, provided it does not produce self-oscillation. A fine adjustment of the reaction effect may be obtained with the Fig. 35 circuit by suitably adjusting the various resistances R_4, R_7 and R_8.

In Fig. 36 we have an example of the use of resistances R_6 and R_7, included in the tuned anode circuit for the purpose of introducing damping. These resistances are of the order of 30 to 50 ohms, but individual experiment is necessary to find what value is best suitable for stabilising the circuit. This method of stabilising tuned anode circuits is one which appeals to the writer as most likely to give general satisfaction, and the arrangement may therefore be classified with Fig. 35 as suitable for general use.

Use of Positive Grid Bias in High-Frequency Amplifiers

We have already explained the use of a potentiometer for the purpose of introducing a positive potential on the grid, thereby setting up a grid current which will introduce damping into the grid circuit, and so secure stability.

This method has achieved great popularity, and is the one which is most usually employed for stabilising a high-frequency amplifier.

Fig. 37 shows a typical example, and here we see the grids of the first and second valves given a varying potential by means of a potentiometer connected across the filament accumulator. A fixed condenser C of 0.002 μF capacity is provided in order to cut out any effect which the potentiometer might have on the high-frequency currents directly. In this circuit, the grid circuits have been tuned, but the same arrangement may be used when the anode circuits are tuned. I am inclined to favours however, the tuning of grid circuit,

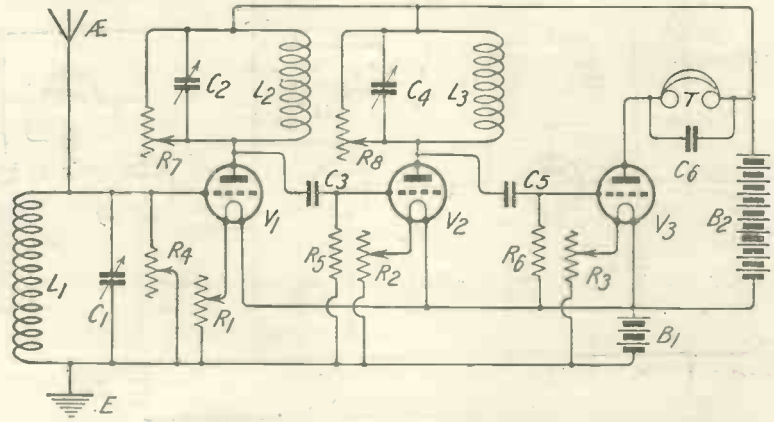

Fig. 35.—The introduction of parallel resistance to obtain stability.

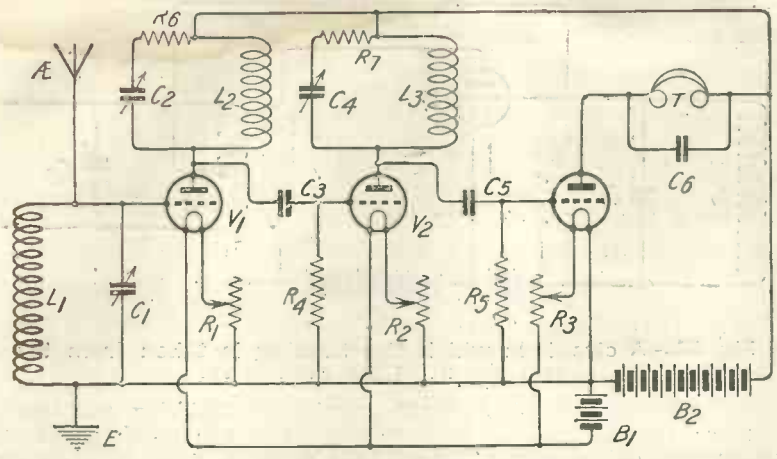

Fig. 36.—Circuit showing series stabilising resistances favoured by the author.

for the reasons set forth earlier in this article.

Capacity Coupling from one Valve to a Preceding One

Reverse reaction may be conveniently obtained, sometimes, by means of a very small variable condenser connected from one of the oscillatory circuits towards the end of the circuit to one of the preceding grid circuits, care being taken that a correct opposing of the grid potentials is obtained.

An example of this kind of circuit is illustrated in Fig. 38, and it will be seen that a reverse reaction condenser C_7 of very small capacity is connected between the anode of the second valve and the grid of the first. I am not at all happy regarding the operation of circuits of this description, and they are, in general, difficult to handle and frequently, if incorrect values are chosen, the condenser which is to eliminate oscillation makes matters worse. I am strongly inclined to believe in stabilising valves individually rather than from end to end of a series of valves.

An example of this latter method is illustrated in Fig. 39.

A Form of Neutrodyne Coupling

The word "neutrodyne" is only used in its generic sense. The word is used, although a proprietary name, in a loose sense to convey circuits in which the capacity of a valve, and other attendant capacities, are balanced out by intentional capacitics. L. A. Haseltine produced a highly effective multi-stage amplifier using small capacities for neutralising inherent capacities in the circuit which produces self-oscillation. Long before any announcement of Haseltine's work was made in America or this country, I was working on similar lines and evolved circuits of a similar general type, and my British patent 217,971, dated January 2nd, 1923, covers all so-called neutrodyne circuits in this country. The first claim reads as follows:—

"A radio-frequency amplifier in which the currents are amplified by a plurality of stages of amplification involving a plurality of tuned circuits, a condenser, or condensers, being connected so as to produce a reverse reaction effect to counteract the tendency of the amplifier to generate oscillations."

Further claims deal with develop-

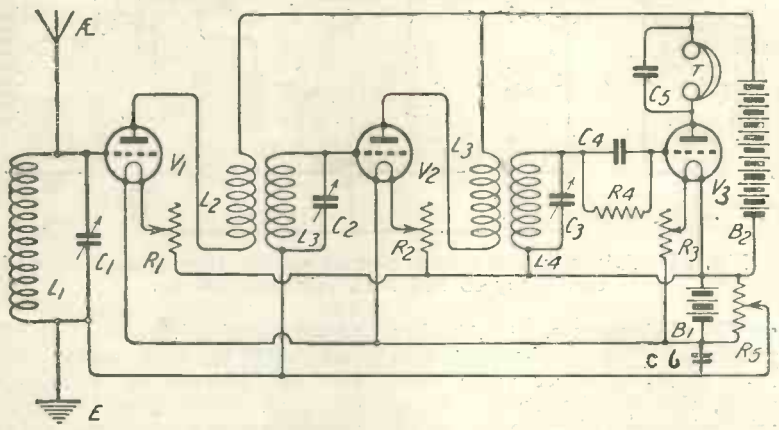

Fig. 37.—Circuit utilising potentiometer control.

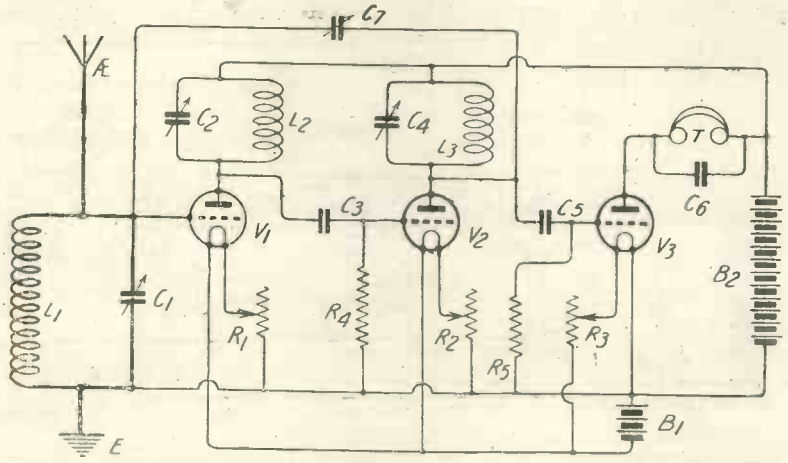

Fig. 38.—A collective method of stabilisation which is difficult to handle.

ments and more detailed arrangements.

It must be noted, however, that much attention had been given, curiously enough, to methods of overcoming the trouble of self-oscillation in single valve receivers, where the fault is less troublesome.

In Fig. 39 a distinctly interesting method is shown in which the connection to the anode battery is made, not from the end of the coils L_2 and L_3, but from points intermediate between their ends. In each case the end of the coil remote from the anode is connected through a small variable condenser to the grid of the valve, the two condensers C_2 and C_5 being for this purpose. The middle tapping on the anode coil results in the two

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While all bright emitter valves and some dull emitters operate at a temperature of at least 2,000 degrees, the Wuncell functions at 800 degrees only.

This graphic comparison proves beyond doubt why the Wuncell will easily outlast two or even three ordinary dull emitters. Obviously its filament will never be subjected to the strains and stresses which inevitably tend to shorten the lives of valves working at a temperature nearly three times as high.

Because it is an *accumulator* dull emitter its filament is quite as stout and as robust as that in the standard P1 and P2 valves. This is indeed a noteworthy achievement and disproves at once the theory that a dull emitter valve must of necessity be fragile and delicate.

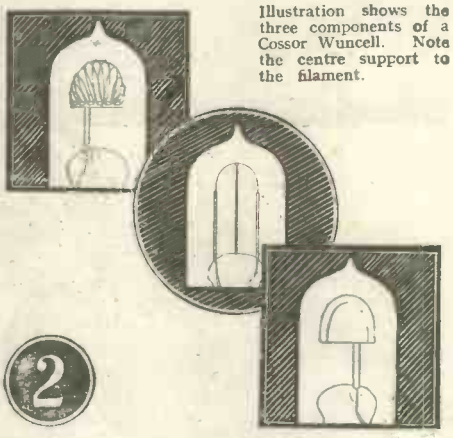

Illustration shows the three components of a Cossor Wuncell. Note the centre support to the filament.

2 Standard Cossor features ensure improved results.

ALL the exclusive features which have made the Cossor the most widely used valve in the country are retained. Its secret of success lies in the capture of practically the whole of the electron emission.

In the ordinary valve with tubular anode a considerable proportion escapes from each end of the anode without serving any useful purpose.

The arched filament of the new Cossor Wuncell is further strengthened by means of a centre support. Obviously, wireless enthusiasts will realise that in any valve the filament is the only vulnerable portion. If the filament can be so designed as to be almost unbreakable and if the valve will function when the filament is barely glowing, then the valve should have an almost indefinite life.

A further point is that the characteristics of all Wuncell valves are an exact match for the same type of valve in the Cossor bright emitter series.

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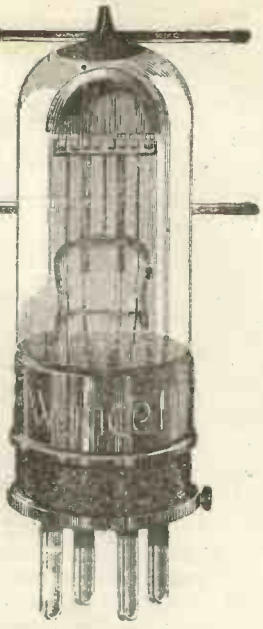

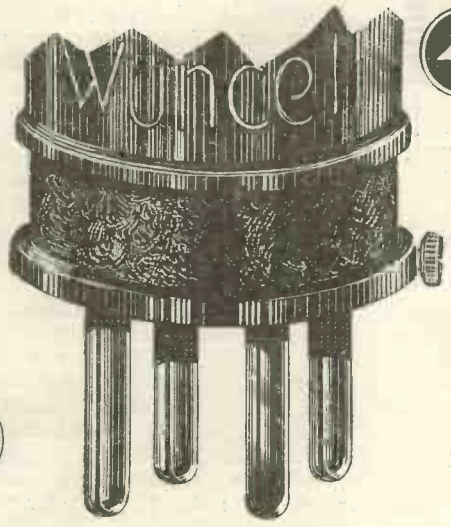

4 Patent Cossor packing ensures safe transit from Test-room to user

—every purchaser is positively guaranteed a new and unused Valve.

HITHERTO, all valves have been sold in unsealed boxes and the purchaser has had no guarantee that the valve is a new and unused one. In future, all Cossor Valves, including Wuncells, are being sold in sealed cartons. *It will not be necessary even for the dealer to break the seal to demonstrate that the valve is in good condition.* A most ingenious system has been worked out to ensure this.

Each valve is packed in a thick wrapper of cotton wool to absorb all shocks. To each end of the two filament legs are attached wires which are carried through the packing and fastened to the two contacts on the outside of the box. If these two wires are placed in circuit with a small battery and lamp, and the circuit completed, the lamp will light. But if, on the other hand, the filament of the valve is broken, the current will not be able to pass, and the lamp will not light. Every dealer is being supplied with a Tesr Showcard which, when the Cossor box is in contact with it, lights up instantly if the filament is intact.

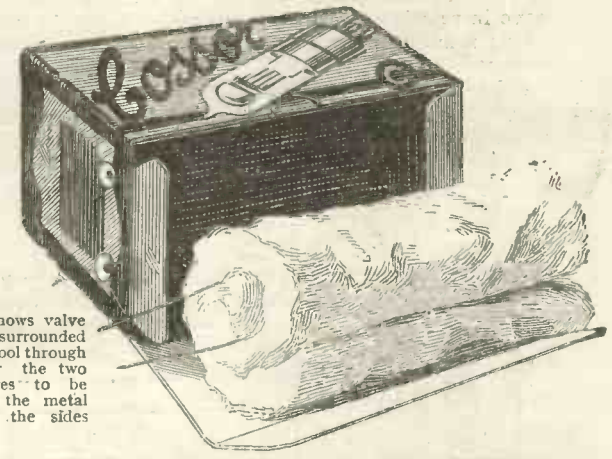

Illustration shows valve completely surrounded with cotton wool through which appear the two filament wires to be attached to the metal contacts on the sides of the box.

3 Patent Resistance permits use with 2-, 4- or 6-volt Accumulator without alteration to Receiving Set.

UP to the present it has not been possible for multi-valve Set users to change over from bright emitters to dull emitters without discarding valves, or else altering the wiring.

The new Wuncell has incorporated in its base a resistance which is in series with the filament and which will permit the Wuncell being used with either a 4- or 6-volt accumulator.

Thus, anyone with a 3-valve set, wishing to change over to dull emitters can use one Wuncell and two bright emitters from the same 6-volt accumulator. A second Wuncell can be purchased and then a third. When all the bright emitters are discarded the resistances within the bases of each Wuncell can be shorted by means of the milled screws provided and the valves will then operate from a 2-volt accumulator. The accumulator itself can be reconnected so that it will give two volts and its output capacity trebled. This patented feature is exclusive to the Cossor Wuncell.

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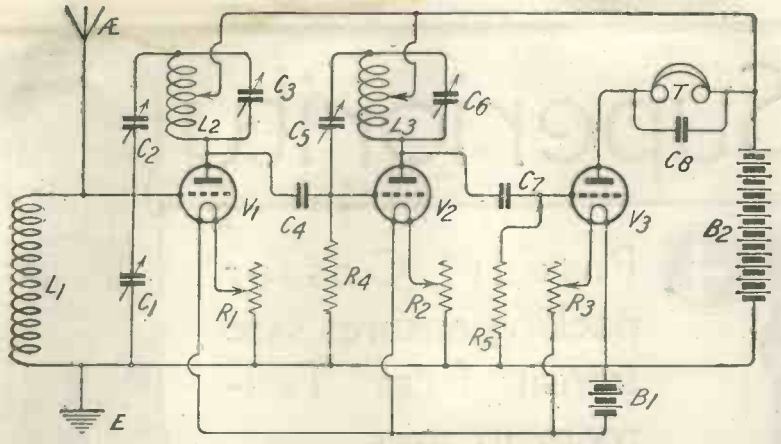

Fig. 39.—Individual stabilisation of two high-frequency valves in which delicate adjustment is required.

ends of the coil L_2 having opposite potential signs with respect to the filament of the valve; in other words, a phase reversal is obtained by the device, and by using a small variable condenser C_2 it is possible to prevent the first valve from oscillating. The same thing is done in subsequent valves, and this method of applying the balance capacity method, or neutrodyne-like principle, to tuned anode circuits may be duplicated.

I have spoken about middle tappings on the coils L_2 and L_3, but the actual position is not very material from the point of view of self-oscillation and its prevention, because the position of the contact is compensated for by a suitable adjustment of the neutralising condenser. The further the tapping is away from the anode, the larger must be the neutralising condenser.

The values of these variable condensers in balance capacity circuits is small, and two plates the size of pennies may be made to move in relation to each other and act as a suitable condenser under most conditions.

I have further suggested the use of small condensers for supplementing the inherent capacity of the valve, and by doing this it is an easier matter to effect a balance; obviously, if the capacities to be balanced are very small, the slightest movement of the hand in an adjustment may make a big difference.

Before leaving Fig. 39, it would be as well to point out that varying the tapping on the anode coil affects the amount of transfer of energy to the next valve. It will usually be desirable to keep the proportion of the anode circuit included in the grid circuit of the second subsequent valve as large as possible. In other words, to have the anode tap as near to the end of the anode coil furthest from the anode as possible.

Adding to Valve Capacity

An example of the circuit in which the valve capacity is added to by means of a variable condenser C_2 is illustrated in Fig. 40. The condenser C_2 is for the purpose of adding to the grid to anode capacity of the valve, while the condenser C_1 is for the purpose of obtaining a reverse reaction effect.

Fig. 41 shows an arrangement which is rather complicated to handle but which involves a middle tapping from the coil L_3 and the balancing of two condensers C_3 and C_4. A long description of the circuit was given in *Wireless Weekly*, Vol. 1, No. 12 of June 27, 1923.

The "Neutrodyne" Circuit

The so-called neutrodyne circuit, if it is possible to use this name in connection with the broad class of circuits of the balance capacity type, is illustrated in Fig. 42. It will be seen that phase reversal is obtained by using transformers L_3 L_4 and L_5, L_6

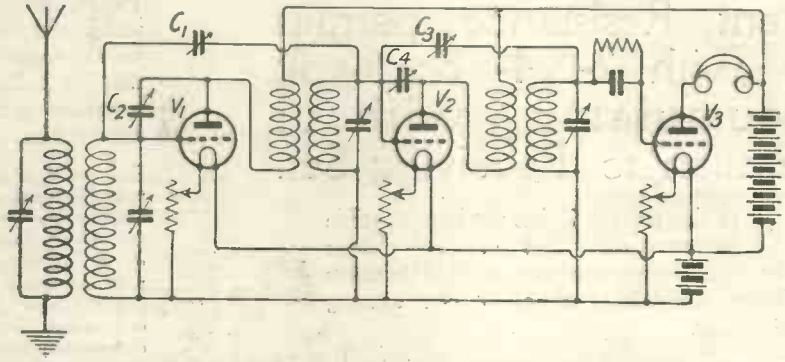

Fig. 40.—A circuit suggested by the author in which stabilising adjustments are less critical than in Fig. 39 circuit.

the condenser C_5 of small dimensions being used to prevent the first valve oscillating and the condenser C_6 to prevent the second doing the same. With these arrangements loose coupling to the aerial is a much more simple matter, because the self-oscillation tendency is

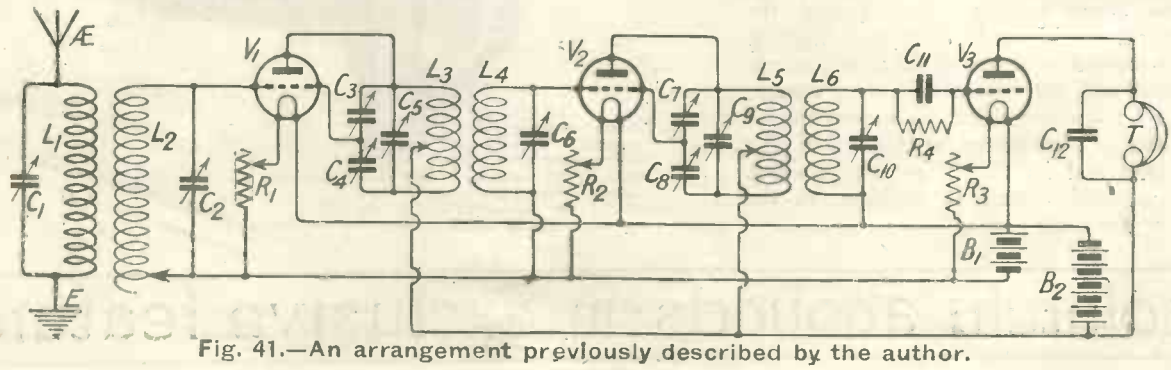

Fig. 41.—An arrangement previously described by the author.

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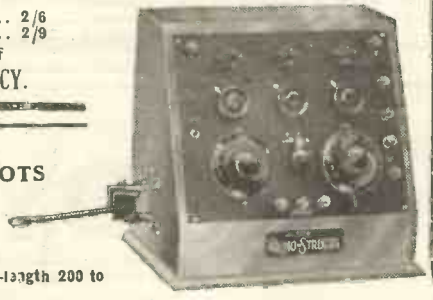

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10½×8½×¼	5/3	*12×11×¼	8/3
*12×10×¼	7/3	*18×6×¼	6/9
*12×12×¼	8/6	*12×8×¼	6/–
14×12×¼	10/–	*10×8×¼	6/9
16×12×¼	11/6	* 7×5×¼	2/3
18×12×¼	13/–	*10×9×¼	5/8
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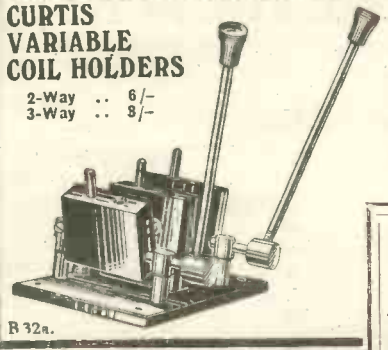

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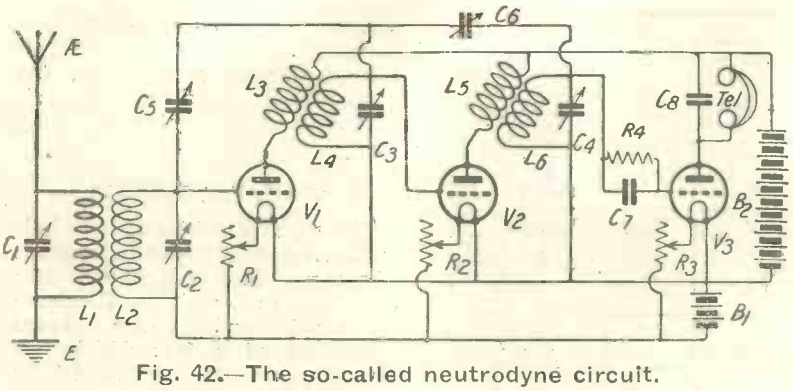


Fig. 42.—The so-called neutrodyne circuit.

prevented by the condenser C_5, and the stabilising effect of a direct coupled aerial is not necessary.

Obtaining a Reaction Effect with Stabilised Circuits

When using stabilised circuits of the balance capacity type, it seems probable that the best arrangement is, not to modify the stabilising, but to stabilise the circuit thoroughly and then to introduce deliberate reaction. For example, in the Fig. 42 circuit reaction could be introduced from the anode circuit of the third valve to the grid circuit of the first by connecting a small reaction coil in series with the telephones.

Mr. Cowper's Work

Mr. A. D. Cowper, M.Sc., has done some valuable work on balance capacity stabilising methods, and a circuit which he has introduced is illustrated in Fig. 43. This class of circuit, like the improved ST.100 and many others, was first published in *Wireless Weekly*. It will be seen that the Fig. 43 circuit is a type which he has introduced and which possesses very marked advantages. A phase reversal is obtained by means of the coil L_4 which is coupled to the tuned coil L_3. One end of L_4 is connected to the filament, and the other end through the very small condenser C_4 to the grid of the first valve. I have carried out very interesting tests with this class of circuit myself and it is remarkably effective. All the advantages of tuned anode coupling are present without the disadvantages of a tendency towards self-oscillation. The maximum values of L_3 and L_2 may be employed with minimum values of the condensers C_2 and C_3, thus producing high efficiency. The coil L_4 may be a plug-in coil of the same size as L_3, while the condenser C_4 for ordinary broadcast wavelengths may be a very small condenser of the two penny size mentioned above.

It is important to connect the coil L_4 the right way round, and reversing leads are desirable in a set made up in accordance with this circuit. The adjustment of the condenser C_4 is very important, and it will be found that there is a certain value which will give freedom from self-oscillation. If this value is either too high or too low the first valve will be prone to oscillate.

Adding Reaction

If it is desired to add reaction to the Fig. 43 circuit, a reaction coil may be connected in the anode circuit of the second valve and coupled to the grid circuit of the first. Such a circuit is illustrated in Fig. 44, L_5 being the reaction coil.

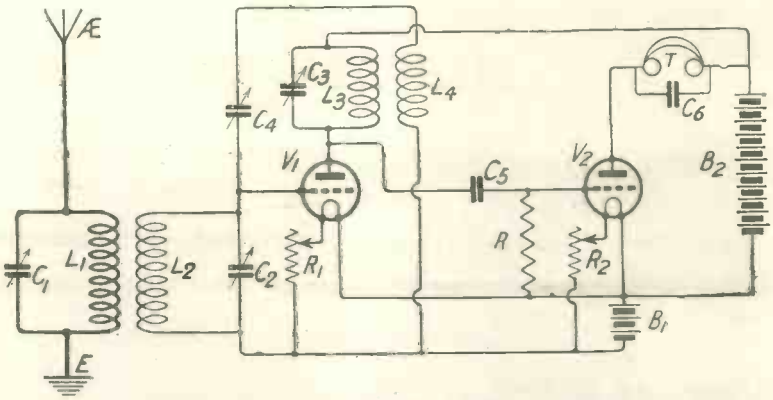


Fig. 43.—The Cowper arrangement of stabilising a tuned anode circuit.

An additional stage of low-frequency amplification may be readily added to this circuit, and a set on these lines giving very excellent results was described by Mr. John Underdown of the Radio Press staff, in the issues of *Wireless Weekly*, dated August 6 and 13, 1924.

The Cowper arrangement using Two Tuned Anode Circuits

A development of the Fig. 43 circuit is illustrated in Fig. 45. It will be seen that the balancing arrangement has been duplicated

Overcoming Magnetic Coupling

It is to be understood that in addition to using the balance capacity method, any of the methods described in these articles for overcoming magnetic coupling may be used. In Fig. 25 it was

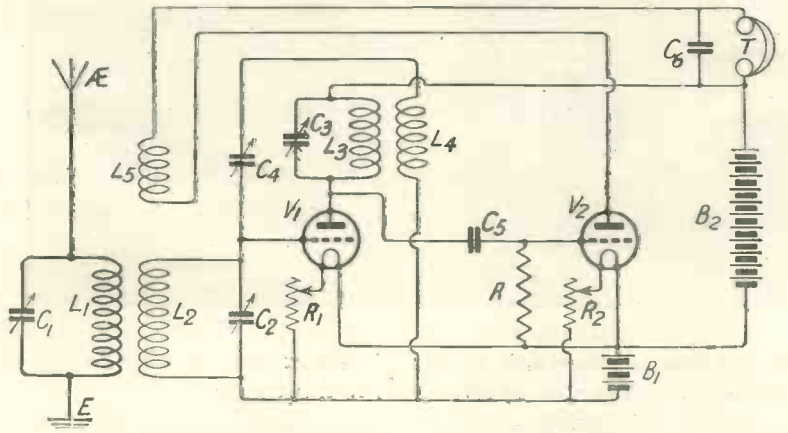
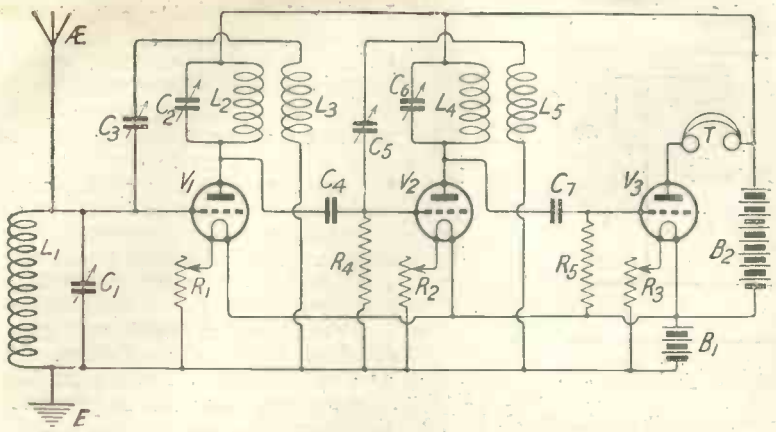


Fig. 44.—The circuit of Fig. 43 with reaction added.



45.—The arrangement of Fig. 44 with two tuned anodes.

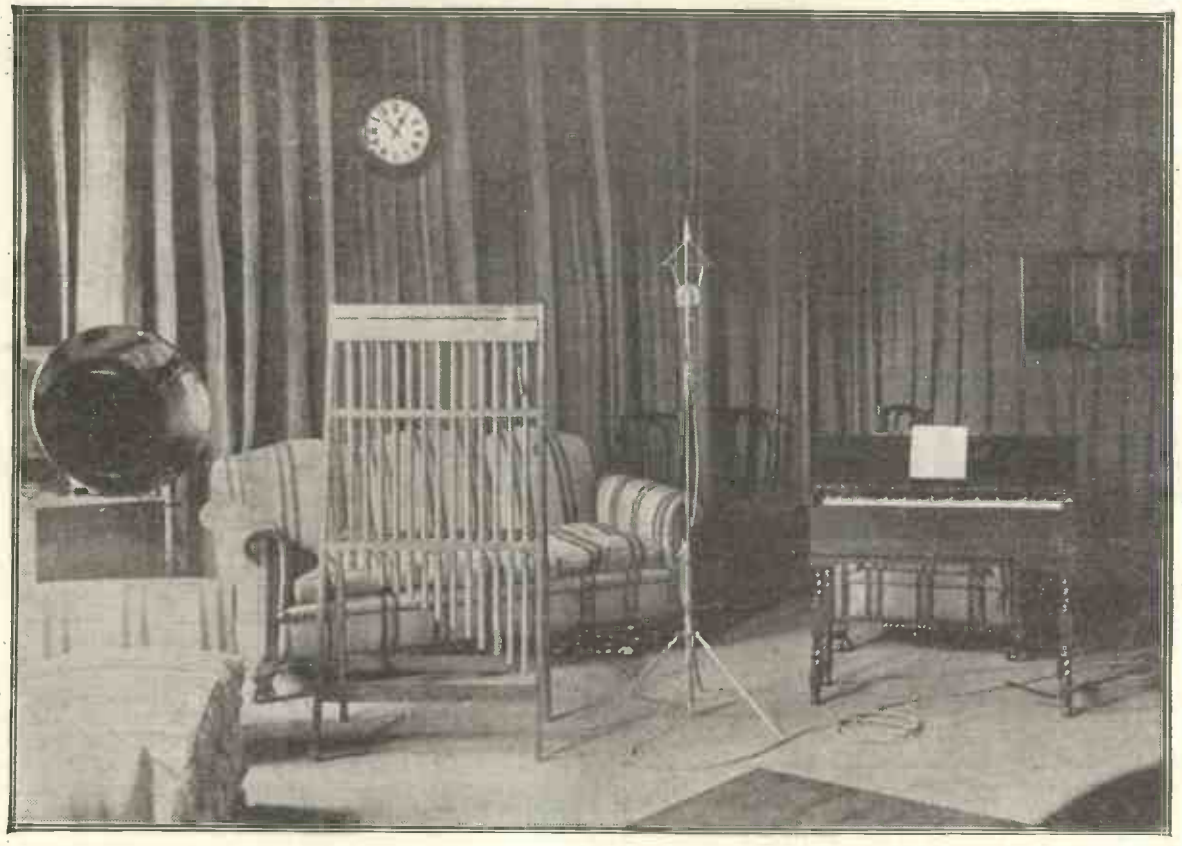
shown that by arranging coils in a " raked " manner, similar to the funnels of a ship, it is possible to overcome a great deal of the inductive coupling which is also a bugbear in multi-stage high-frequency amplification. In all the arrangements described, the use of transformers or anode coils may profitably involve arranging the coils in a raked manner.

Concluding Remarks

This series of articles will conclude in the next issue with a description of a new method of high-frequency amplification which I have developed and which takes advantage of a fact which has hitherto apparently not been fully realised. It had been proposed to include a description in this issue, but, owing to space considerations, it has been found necessary to hold the description over till the November issue.

(To be continued.)

THE EDINBURGH STATION



The photograph shows the general appearance of the studio at the Edinburgh relay station. Difficulty has been experienced with the range of this station.

Early "Wireless" History

By H. J. HINKS, F.R.A., M.I.E.E., Etc.

A resumé of the art in pre-Hertzian days.

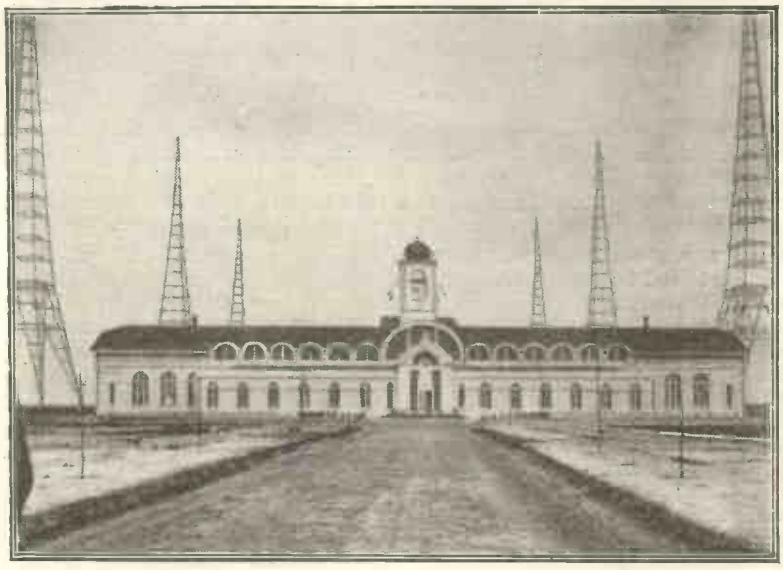
MANY books dealing with "wireless" history commence with a description of the discoveries of Hertz. The writer thought it would be interesting to ascertain whether any epoch-making discoveries or inventions had been made in the matter previous to the conception of Hertz's now world-famed discovery. This has entailed a good deal of reading, and much of the material perused in the process was found irrelevant, and consequently rejected.

Systematic methods of signalling were in use by the Greeks and Gauls in 300 B.C., whilst the use of fires by night, smoke by day, and a drum or elliembec, has long been practised by the native tribes, who, according to Garner, could by the drum method transmit messages for three miles. This kind of signalling is often considered to be the forerunner of modern wireless telegraphy.

When referring to electrical matters, it is difficult to realise that over one hundred and sixty years ago, Franklin, in America, and a Dr. Watson, Bishop of Llandaff, sent signals without wires by transmitting electric shocks across rivers.

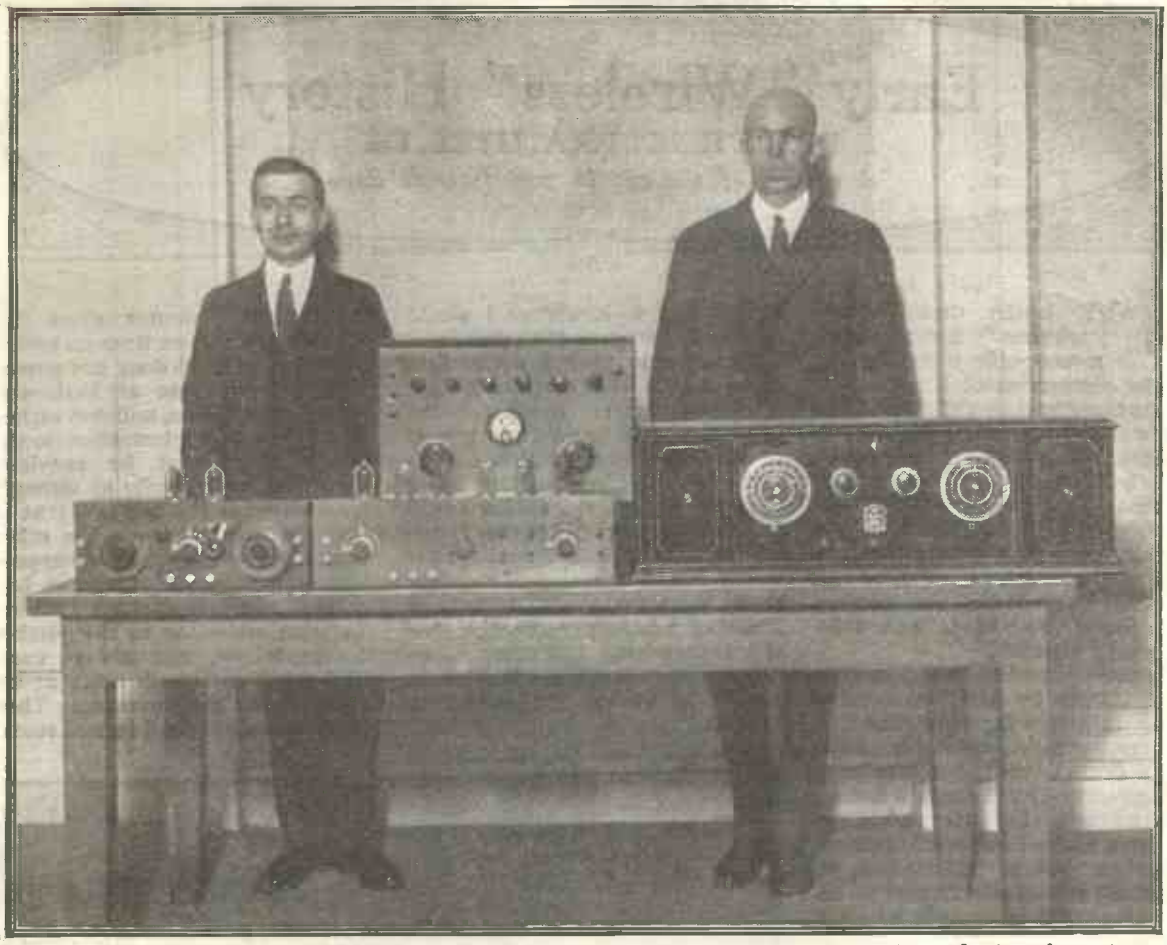
Most articles or books dealing with a matter such as the present are considered incomplete without some reference to prophecy, and in order that the present article may not be lacking in this respect reference is here made to the fact that Galileo is said to have visualised wireless communication. In support of this, the subjoined extract has been culled from a book on the electric telegraph, written by Sabine, where, however, it has been supposed that the statement was prophetic of telegraphy with wires, though it has since been considered to forecast other forms of communication. The extract is as follows:

"You remind me of one who offered to sell me a secret art, by which through the attraction of a certain magnet needle it would be possible to converse across a space of two to three thousand miles. And I said to him that I would willingly become the purchaser provided only that I might first make a trial of the art, and that it would be sufficient for the purpose if I were to place myself in one corner of the sofa and he in the other. He replied that in so short a distance the action would be scarcely discernible, so I dismissed the fellow, and said that it was not convenient for me just then to travel into Egypt or Muscovy for the purpose of trying the experiment, but that if he chose to go there himself, I would remain in Venice and attend to the rest."



The giant masts at the Lafayette station near Bordeaux are a landmark for many miles.

The indication given that scientists of Galileo's time were aware of the action of magnetic needles may be confirmed by referring to Strada's work, "Prolusiones Academicæ" (1617). The description therein formed, nearly two hundred years later, the basis of a novel. Such confirmation may also be found in Schwenter's book, "Deliciæ Physico-Mathematicæ," published in 1636, which, by the way, refers to a magnetic telegraph. Schwenter gives the following quotation from an earlier source, which he does not name: "If Claudius were at Paris and Johannes at Rome, and one wished to convey some information to the other, each must be provided with a magnet needle so strongly touched with the magnet that it may be able to move the other from Rome to Paris. Now, suppose that Johannes and Claudius had each a compass divided into an alphabet according to the number of the letters, and always communicated with each other at six o'clock in the evening. Then (after the needle had turned round three and a half times from the sign which Claudius had given to Johannes), if Claudius wished to say to Johannes 'Come to me,' he might make his needle stand still or move till it came to c, then to o, then to m, and so forth. If now the needle of Johannes' compass moved at the same time to the same letters, he could easily write down the words of Claudius, and understand his meaning. This is a pretty invention, but I do not



Major Armstrong (right) and Mr. Hor·ck (left) standing by two examples of the Armstrong superheterodyne. That on the left is the original model, while on the right is shown the latest pattern.

believe a magnet of such power could be found in the world."

Galileo's forecast of wireless communication was considered sufficiently interesting to discuss with a few friends. One of them stated that the Book of Job had often been cited as prophetic of radio, and a search showed that he evidently had in mind the 35th verse of the 38th chapter of that Book, which reads :—" Canst thou send lightnings, that they may go, and say unto thee, 'Here we are?'" The writer, of course, does not consider this an actual prophecy. Nevertheless, in view of modern developments, the phraseology is very remarkable.

The thread of discovery incidental to wireless telegraphy may be considered to commence with Huyghen's theory that light is propagated by ether vibrations, a fact which was established by Maxwell in 1873, who, by the way, contended that the propagating medium of electro-magnetic waves was identical with that of light.

Reference to Maxwell's contention reminds one of a remark made by the great scientist Faraday, apparently when discussing the matter with Maxwell, that "it was allowable to admit that the propagation of electricity might be effected by means of ether."

In the search made, it was found, curiously enough, that all ensuing discoveries (about the middle of the nineteenth century) can be considered to deal with the transmitting side of the question, as they relate to electric discharges, the earlier discoveries being relative to the discharge of the Leyden jar. Professor Joseph Henry, of Princetown, in the United States of America, who was one of the leading scientists of the time, produced, by the aid of an electric machine and a Leyden jar, a spark in one room of his residence, and ascertained that an induced current was set up in another apartment of the same building.

The earliest reference to the use of an electric current in producing a spark is dated about the year 1800, and relates to an experiment made by Sir Humphry Davy, in which he used a galvanic battery comprising a considerable number of cells, and succeeded by their use in producing the first voltaic arc or spark between two carbon electrodes. The reader should be reminded that ordinary line telegraphs were known at this time, that the earliest records relating to line telegraphy are dated 1774), and that Prof. Morse, although not the originator, as often supposed, is accredited with suggesting in 1832 a practical system of line telegraphy. Morse's system was further simplified by the invention of Steinheil in 1838, incorporating an earth return. There is no doubt that Morse was the pioneer of signalling without wires, for on December 16, 1842, he sent a wireless message across a canal, and later a Mr. Gale, acting under his supervision, established wireless communication over nearly one mile.

In view of present-day developments, it is interesting to note that the apparatus used by Morse comprised four plates, which were immersed in the water of the canal across which the signals were sent, two plates being situated near

each bank, and attached to an insulated wire extending along each shore for a distance three times as great as that which measured the path of the signals.

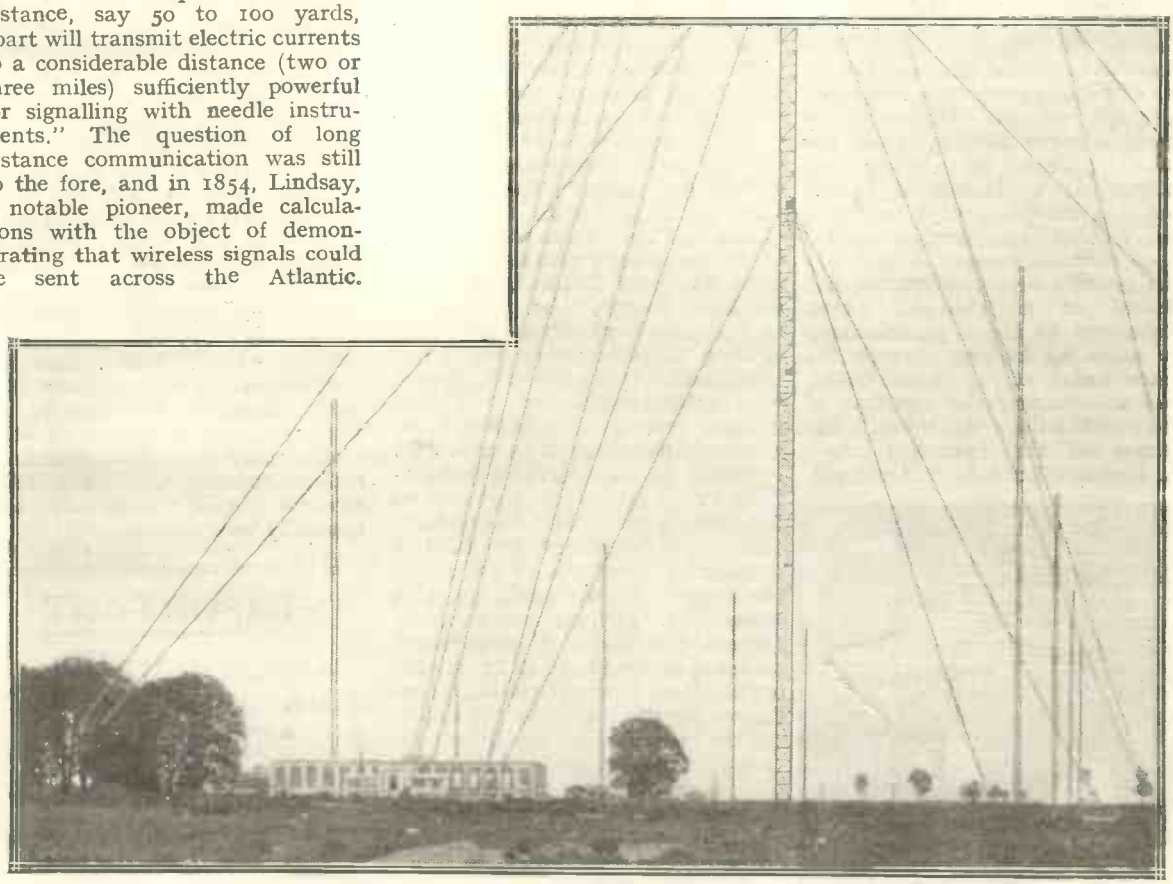
Even at so early a date, long distance communication was under discussion. The *Mining Journal* of March 31, 1849, contains a proposal made by J. W. Wilkins for a telegraphic communication between England and France, and those who wish to investigate the matter more fully may refer to British Patent Specifications Nos. 96 of 1853 and 2498 of 1853. The system, it is believed, was re-invented by Trowbridge (1880) in America. Practically all the systems of wireless telegraphy invented about this time may be classed under the general heading "Sub-aqueous Telegraphy."

Not only in England and America were investigations made, but also in India by Dr. O'Shaughnessy, who found that the instruments in use at the time were subject to such derangements that serious interruptions were very frequent. After experimenting about ten years, he was able to report to the Telegraph Department in 1858 that he had ascertained "that two naked uncoated wires kept a moderate distance, say 50 to 100 yards, apart will transmit electric currents to a considerable distance (two or three miles) sufficiently powerful for signalling with needle instruments." The question of long distance communication was still to the fore, and in 1854, Lindsay, a notable pioneer, made calculations with the object of demonstrating that wireless signals could be sent across the Atlantic. Lindsay had no knowledge of the Morse experiments in America, but his ingenuity and keenness of perception will be understood when it is stated that he devised a system of wireless communication (British Patent No. 1242 of June 5, 1854) which enabled him, after a series of experiments, to send signals across the River Tay at a point where it is about two miles wide. According to Fahie, it is stated of Lindsay: "On one occasion, and when an Atlantic telegraph began to be seriously debated, the difficulty of finding a steamer large enough to carry the cable was discussed, when Lindsay quietly remarked—'If it were possible to provide stations not more than twenty miles distant all the way across the Atlantic, I would save them the trouble of laying any cable.'"

Lindsay was a notable character in many respects, as not only did he demonstrate signalling across the Atlantic but predicted the universal employment of electric light and power. In fact, it is recorded that in 1835 the apartment in which he lived was illuminated by an electric lamp. Curiously enough, too, although the universality of present-day wireless telegraphy was not known to him, he was a capable linguist, and devoted much of his time to the preparation of a dictionary comprising fifty languages, which he called "A Pantecontaglossal Paternoster." Probably many readers may care to refer to the abstract of a paper which this capable inventor read before the British Association at Aberdeen in September, 1859, on the subject of "Telegraphing without Wires."* It is most interesting. Other references are *Chambers' Journal*, 1854, and "Wireless Telegraphy," Kerr (1898), p. 40.

Patents relating to an improved method of conveying electric signals without the intervention of any continuous artificial conductors were taken out by John Haworth on March 27, 1862, and October 30, 1863. It is difficult to say what impression Haworth's experiments and patents conveyed to experts at the time, for the *Electrician* journal of 1863 contains a record of heated correspondence between Haworth and another person.

* Twenty-ninth Report of the British Association, Aberdeen, 1859, miscellaneous communications, mathematics and physics, pp. 13-14.



The masts at the St. Assize station near Paris.

A considerable number of investigators were now tackling the problem of wireless telegraphy. Space does not permit of dealing with their inventions to the degree one would wish. It must suffice therefore to mention the most important names and the year of discoveries: J. H. Mower, 1868; M. Bourbouze and Von Bezold, 1870; and Mahlon Loomis, 1872. It is to be noted, in passing, that Loomis, in his American Patent of July 30, 1872, proposed to utilise the electricity of the higher atmosphere for telegraphic purposes, and that Von Bezold discovered that oscillations giving rise to interference phenomena were set up by a condenser discharging into a conductor.

The brothers E. and H. Highton, investigators of note, embodied in a paper before the Society of Arts (see *Journal* of the Society of Arts, May 3, 1872, p. 506 et seq, Highton on "Telegraphy without Insulation") the results of their experiments. They proposed to use as a detector a gold leaf instrument acted upon by a powerful electric magnet, having its motions optically enlarged. It is mentioned in British Patent No. 545 of Feb. 13, 1873, and reports of the great delicacy of the instrument appear in the *Telegraphic Journal* of Feb. 15, 1874. The popularity of the Highton system is emphasised by the fact that a pupil of the Hightons, by name George Dering, took out many patents for electric and telegraphic appliances, and that between the years 1858 and 1874 many other experimenters worked upon the same system. Apparently the patents were unsupported and devoid of experimental proof. Reference to these patents may be made by looking through the name index at the Patent Office, and ascertaining the numbers of the specifications therefrom. The names of the inventors are—A. Barclay, Lord A. S. Churchill, J. Molesworth, A. V. Newton, W. E. Newton, B. Nickels, H. S. Rosser, T. Walker and H. Wilde.

The reader will have deduced from preceding remarks that means of detecting and receiving wireless signals were in use at an early date. It was not until the years 1876-7, however, that a really sensitive detector was in the hands of investigators. The invention of the telephone is referred to, but as this matter has received considerable attention in books devoted exclusively to it, it is not considered necessary to dwell upon the matter here. It is important to note that in 1882 the Chief Engineer of the Government Telegraphs in England used the telephone receiver for detecting signals sent across the Solent from England to the Isle of Wight when using the circuits employed by Morse and Lindsay. Sir William Preece, the Chief Engineer to whom reference is made, was extremely interested in the matter of signalling across space, and there is no doubt that he did much good work in this respect, and placed wireless telegraphy in this country on a footing which it might otherwise never have attained. In his early work he improved transmission in a remarkable degree by the use of a buzzer instead of a tapping key.

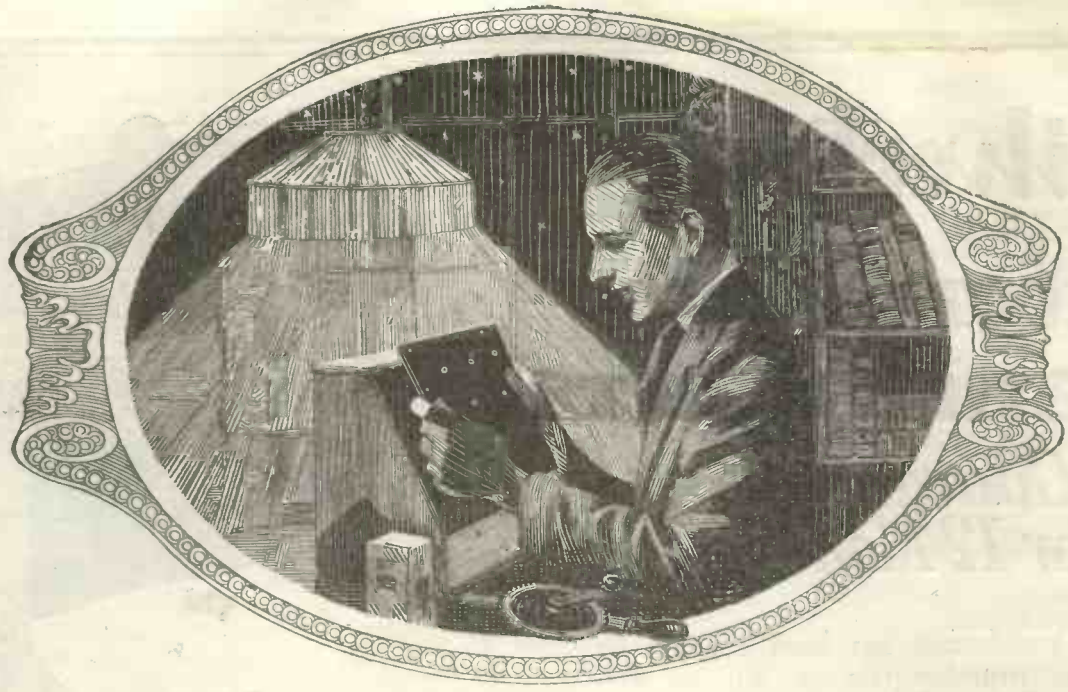
A foretaste of wireless telephony is recorded in the *Electrical Review* of March 1, 1879, where Loomis, referred to above, is thus reported—"With telephones in the aerial circuit he can converse a distance of twenty miles." The editor of the *Electrical Review* appears to have had his doubts about it!

Contemporary with Graham Bell was Professor Dolbear, of Tuft's College, Boston, who constructed a very simple apparatus for establishing communication over short distances. This apparatus formed the subject-matter of a United States patent specification, and became the centre of interest at a meeting of the American Association for the Advancement of Science in 1883, in which year an inventor, Fitzgerald, suggested a method of producing electromagnetic waves in a space by the discharge of a condenser. Dolbear subsequently invented a means of establishing wireless communication by the use of insulated elevate l plates. There is not anything to show the utility of the invention for signalling over any distance, as reports of Dolbear's inventions are very inconsistent.

Those who proudly refer to the recent possibilities of radio are to be reminded that Mr. Edison, in 1885, signalled through space to a moving train from a wire beside the railway, using such inductive effects as he had observed when inventing the singing telephone, which was developed soon after the telephone receiver made its appearance.

Another invention of significance, and one which will interest nautical readers, is that of Professor Graham Bell, described in *Public Opinion* for July 31, 1886, which relates to a system of wireless telegraphy for the purpose of communicating between two vessels, comprising a wire trailing from the sterns of ships. It is stated in the article that ships so provided, and having a telephone on board, can in a fog keep out of the way of other ships provided with a trailing wire connected to an electric generator. Bell is reported to have said—"The matter is so simple that I hope our ocean steamships will experiment with it."

This cursory survey now brings us to Calzecchi Onesti's and B. E. Hughes' (1879) observations on the conditions which produced coherency among metal filings, and the crowning achievement of Hertz in 1886-7. Wireless telegraphy thenceforward still continued to develop apace, many inventors contributing to its advance. The story of such achievement to the time of the introduction of Marconi's really practicable system of radio-telegraphy, and the more modern developments, is now generally well known.



The new—and better—way to buy your Panel———

EVERYONE is beginning to realise the tremendous influence exercised upon the working of a Set by the Panel. A man may buy the finest components and build up a Receiver to the exact instructions of the author and yet get poor results—his efforts having been nullified by a leaky panel.

Ebonite varies tremendously in quality because the material from which it is manufactured also varies considerably. Whether sold with its original polish or with a matt surface it is particularly difficult for the ordinary wireless enthusiast to judge its qualities. Particularly is this so when it is sold with a matt surface.

The only safe way of choosing a panel for your next Set is to select a material you can readily identify and which is fully guaranteed—such as Radion, the only insulation material from which the highly polished surface need not be removed when used for Wireless.

WHAT IS RADION?

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HOW RADION IS SOLD.

RADION is sold in 21 different sizes and each panel is packed in a thick protective envelope. There is no waiting for your dealer to cut your piece from the sheet—and perhaps damaging its surface in so doing. Each panel is cut dead square and its edges accurately ground.

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RADION is sold in a highly polished black, and also as a superb material called "Mahoganite," which faithfully reproduces the delightful high-lights and tints so valued in mahogany. Condenser and rheostat dials and knobs can be obtained to match.

RADION SIZES AND PRICES:

Size	Black	Mahoganite	Size	Black	Mahoganite	Size	Black	Mahoganite.
6″×7″	3/6	4/3	7″×14″	8/–	10/3	8×″26″	17/6	21/3
6″×10½″	5/3	6/6	7″×18″	10/6	12/9	9×″14″	10/6	12/9
6″×14″	7/–	8/6	7″×21″	12/3	15/–	10×″12″	10/–	12/–
6″×21″	10/6	12/9	7″×24″	14/–	17/3	12×″14″	13/3	16/–
7″×9″	5/3	6/6	7″×26″	15/–	18/6	12×″21″	18/9	24/3
7″×10″	5/9	7/3	7″×30″	17/9	21/6	14×″18″	19/9	24/3
7″×12″	7/–	8/6	7″×48″	28/–	34/6	20×″24″	39/6	48/–

Special Note:—All ¼″ thick—quite sufficient owing to Radion's tremendous strength.

LOOK FOR THE NAME RADION.

The safe way to buy your panel, therefore, is to choose a RADION Panel—and look for the name RADION. It is a guarantee against leakage—its surface is beautifully polished and will not gather dust—its strength and composition render it ideal for drilling, tapping and engraving—and it will not crack when cut. *Get it at your Dealer's to-day—but be sure it is RADION (the name is on every panel).*

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This transformer has been adopted by leading manufacturers of Wireless Receiving Sets and discriminating amateurs in all parts of the world.

High amplification without distortion and complete freedom from internal noises.

Correct design, high-class finish.

Excellent results have been obtained on tests carried out by the National Physical Laboratory. Copy of the curve can be had on application.

For more than 50 years we have been manufacturing electrical apparatus, a period of experience that guarantees consistently high quality in our wireless accessories. There can be no better assurance of reliability than the name "Silvertown."

Stocked by our Branches throughout the Country and by dealers in first-class Wireless Accessories.

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LEEDS : 1, New York Road.
LIVERPOOL : 54, Castle Street.
LONDON : 100 and 102, Cannon Street.
MANCHESTER : 16, John Dalton Street.
NEWCASTLE-ON-TYNE : 59, Westgate Road.
PORTSMOUTH : 49, High Street.
SHEFFIELD : 88-90, Queen Street.

Readers' Experiences

Some interesting results obtained by readers who have made the Crystal Set described by Mr. Harris last month.

To the Editor of MODERN WIRELESS.

SIR,—In accordance with the invitation of Mr. Percy W. Harris in the September issue of MODERN WIRELESS, to send in reports of results obtained on the crystal set described by him, I give below my results, having constructed the set a week ago.

To begin with, the components are all separate and not mounted on a panel, the only mounted part being the coil on a piece of ebonite, 4 in. by 4 in. by ¼ in., to carry the switch studs and terminals. The coil is constructed as in the book, with the exception that I used wood soaked in hot paraffin wax for the former instead of ebonite. My aerial is a twin L-type, 30 ft. high and about 70 ft. long.

On connecting up 2 LO came in with about 50 per cent. more strength than I have ever had it on a crystal, the switch studs being in Fig. 7 position and about 90 degrees on the condenser, which, by the way, is .0003 mfd., tuning being fairly sharp. On disconnecting the earth wire and readjusting the condenser, London could still be heard plainly enough to hear what was being said.

Included in the circuit is a Dewar switch which I use for a quick change over to compare 5 XX with 2 LO, the loading coil used consisting of 112 turns of 22 S.W.G. enamelled wire on a former 4½ in. diameter. When this is connected 5 XX is stronger than London, and their generator hum is plainly heard. This is not local.

All the above results were obtained on the outdoor aerial.

I have also constructed a frame aerial consisting of 24 turns of 22 S.W.G. enamelled wire on a frame 2 ft. 4 in. square. When this aerial is connected 2 LO comes in with the same strength as I used to get it on my old set, which shows the efficiency of Mr. Harris's arrangement. The position of the switch studs is as Fig. 2 position, with 30 degrees on the condenser, tuning being very sharp.

On Thursday night I borrowed a Western Electric loud-speaker, and 5 XX could be heard three feet away on my outdoor aerial. Speech was just audible, which I think is rather a good performance. My detector consists of a Neutron crystal and silver wire cat-whisker.

The distance of my house from 2 LO is about eight miles and from 5 XX about thirty-one miles.

This arrangement of Mr. Harris's should become very popular among crystal enthusiasts and he is to be complimented upon it.

Wishing MODERN WIRELESS and the staff every success.—Yours truly,

C. O. FARRER.

N. Woolwich. E. 16.

To the Editor of MODERN WIRELESS.

SIR,—In response to the invitation, I am sending an account of the results obtained from the crystal set designed by Mr. Percy W. Harris and described in the present issue of MODERN WIRELESS.

Let me say in the first place that I, too, find that the set gives the loudest signals of any crystal receiver I have made or heard. I am one of those who delight in the constructional opportunities Radio affords, and altogether I have made some thirty crystal receivers. My opinion of Mr. Harris's set is based upon the experience thus gained and is given for what it is worth.

I have been striving for a long time to get a first-class set and have tried out a good number of those described in the various Wireless Journals. It is true some of these gave good results, but none of them came up to the standard I had set for myself. The receiver outlined in the September MODERN WIRELESS fulfils my ideal completely and is well worth the trouble entailed in making it.

I have tried the various combinations of the switch studs and condenser, and my findings are given below :—

Top switch. No.	Bottom switch. No.	Condenser reading.	Remarks.
4	2	150	Excellent.
1	2	110	
2	4	20	
3	4	20	
4	3	0	Very fair, better with the vernier at 90.
2	3	0	Fair, better with vernier at 180.
3	2	0	Moderate.
1	3	0	Poor.

It is very difficult to say which of the first four arrangements gives the best result, but I think the placing of the above indicates the order of their merit.

My aerial is a single wire, which including the lead-in is about 80 ft. long, and 32 ft. high. The earth lead is approximately 15 ft. to the main water tap.

Though I made the hinged door in the cabinet as described in the article, I placed the detector (a glass enclosed one) on the top of the panel. I used the ordinary 1½ in. radius switch arms, otherwise the set is constructed like the one outlined by the author.

May I in conclusion congratulate Mr. Harris on designing so efficient a set, and one, because of the variety of circuits employable, which is so interesting to handle.—Yours truly,

FREDK. J. WAITING.

Earlsfield, S.W. 18.

To the Editor, MODERN WIRELESS.

SIR,—I recently constructed two crystal sets to the instructions given in your paper for the month of June last (MODERN WIRELESS special design), and was extremely well pleased with their performance. This set gives very loud and clear signals, tuning sharply, and as stated in the test report, gave the

best signals on the smallest part of the inductance. It gives good performance on an indoor aerial two miles from 6BM, and on a low 80 ft. aerial eight miles from 2LO the signal strength is little less. I hope later to test it at W. Lulworth, 20 miles from 6BM.

Last week I also tested Mr. Percy Harris' crystal set described in the September number. On an 80 ft. outside aerial, two miles from 6BM (the effective height of the aerial is not more than 15 ft.) speech is plainly heard in a small Amplion L.S. 14 ft. away—the loudest signals being obtained with aerial switch-arm on first tapping stud and earth switch-arm on the stud connected to the second tapping—a .0005μF V. Condenser reading 50 degrees.

By using the set's coil as a tuned aerial inductance only and a closed circuit — untuned — including crystal detector and 'phones, consisting of a home-made basket coil of about 250 turns of No. 28 S.W.G. D.C.C. wire fastened to the back of the frame coil of the set, the signals are very much louder still, but I am puzzled as to why I get the best result from the middle 20 turns on this wavelength.

These are both most excellent sets and well worth making. I shall be interested to read the results obtained by other readers at a greater distance from a broadcasting station.—Yours truly,

C. F. K.

Bournemouth.

To the Editor, MODERN WIRELESS.

SIR,—I have just completed the crystal set described in the September number by Mr. Harris, and obtain better results than with any other I have yet tried, although sceptical prior to construction.

Aerial.—Five lengths of 7/22 H.D. copper on insulators (shell) screwed to underside of roof and parallel to frontage (16 ft.) of house; brought down fanwise at one end to a common point, joined to heavily insulated (lighting) wire, and brought down through the house where required.

Earth.—7/20 (lighting) wire to brass clip on water pipe under floor, approximately 10 ft. from set.

Position.—Elevated, and not less than two miles from 5PY.

Modifications.—Panel made ¼ in. wider to permit of lowering positions of condenser and lower switch-arm, and to place detector outside at a position midway between 'phone terminals. Slots in coil former 1¾ in. Standard switch-arms shortened to ¾ in. radius. Coil stowed parallel to panel reducing space required by 1 in., and leads from coil to back being about equal in length.

Tuning.—Top switch No. 2 stop. Bottom switch No 3 stop, and condenser at 0 degrees.

Crystals tried.—Tungstalite (red and blue labels).

Wire required.—Just under 1 lb. 16 D.C.C.

Set wired with same.

You may make any use you wish of the above information, and I wish to express my thanks to Mr. Harris in particular for the very efficient set he has described.—Yours truly,

T. E. FACEY.

Devonport.

To the Editor of MODERN WIRELESS.

SIR,—I have just completed the crystal set as described by Mr. P. W. Harris in the September number of your valuable magazine, MODERN WIRELESS. The results are exceptionally good. Chelmsford (which is 38 miles direct as wireless waves travel) can be heard on a large Amplion 25 ft. away so as to be able to recognise the tune the band is playing. This is with a 150 Igranic coil, plugged in the loading coil plug. I can also hear Radiola, but 5 XX can still be heard. The time signals can be heard from FL with a 300 coil plugged in. London (66 miles direct), comes in quite clear; but not much volume. Also Bournemouth and Cardiff. These latter stations with a 35 coil plugged in. I can hardly separate these stations whilst the three are working. Bournemouth fades quite a lot. I have made up quite a lot of your crystal sets, but this, no doubt, is the best by far up to the present. I have nearly completed your 3-valve dual and feel quite confident it will work just as well as all the other circuits I have made up from MODERN WIRELESS. You ask to state if indoor or outdoor aerial, which of course, you know, is outdoor in this case, 35 ft. high, 75 ft. long, single wire.—Yours truly,

R. A. Q.

Needham Market, Suffolk.

To the Editor of MODERN WIRELESS.

SIR,—I have constructed the crystal set shown in MODERN WIRELESS September issue by Mr. Harris, and I get excellent results from it.

I have tried practically all the crystal circuits which have appeared in MODERN WIRELESS since last year, but this is undoubtedly the best. I can tell when the Savoy Band comes on, when about 8 ft. away from the headphones.

I am just three miles from 5 SC, and my aerial is 30 ft. high and 38 ft. long, single; the aerial wire

consists of about 100 strands of bare copper wire about .004 in. diameter. Best position for switch arms, aerial 3rd from right. Earth 1st on right.—Yours truly,

DOUGLAS P. MUIRHEAD.

Cathcart, Glasgow.

To the Editor of MODERN WIRELESS.

SIR,—With reference to your article on the new crystal set in MODERN WIRELESS, I write to let you know that I have successfully constructed it and that it works "O.K." With an L-shaped aerial of about 55 ft. in length and 35 ft. high, using the second stud on the top switch (reading left to right), and No. 4 on the other, all comes in well. (By using the fourth stud on the top switch and the second on the other and also rotating the condenser 180 degrees reception is as before.) We are situated just outside the five mile radius, near Wandsworth Prison.

Wishing every success to MODERN WIRELESS and *Wireless Weekly*.—Yours truly,

G. A. SAUNDERS.

Wandsworth.

To the Editor of MODERN WIRELESS.

SIR,—It's the goods. Quite the loudest crystal set I have heard. Fig. 3 arrangement suits aerial (outdoor) best. I am thirteen miles from 5IT. It is honestly as good as one valve. I think it quite capable of working on an indoor aerial. At any rate, I shall try. I should also like to mention my results with the famous ST 100. 5IT is of course deafening, and loud-speaker heard plainly 50 yards away. The same station is worked also on indoor aerial and heard all over house. Most B.B.C. stations also on indoor aerial. It's really wonderful. My best thanks for same and also for your wonderful papers, MODERN WIRELESS and *Wireless Weekly* which eclipse *all* others.—Yours truly,

J. RABY.

Wolverhampton.

To the Editor of MODERN WIRELESS.

SIR,—Having built your new type crystal set, page 337, September issue MODERN WIRELESS, I am writing to let you know of results obtained. I wired the set up last night and connected it up about 9.30, and as soon as the cats-whisker touched the crystal I heard London. A slight turn of the variable condenser gave me very good reception, just nice for phones. The next thing I did was to vary the setting with switches as in Fig. 3. I received Birmingham quite readably when announcer was speaking, music being very good. I have heard the opera this evening, September 11th, from Birmingham. While listening on this set to the news last night I turned the condenser about 5 degrees outwards and I heard a soprano singing not very loud. This was about 10.10. My aerial is exactly 100 ft., including lead in; it is 45 ft. high at one end and 30 ft. at the other. The earth wire is connected to a three-gallon oil tin buried about 3 ft. deep. I am situated 35 to 40 miles from 2LO, and about 90 to 95 from Birmingham.—Yours truly,

P. BLOOM.

Letchworth, Herts.

To the Editor of MODERN WIRELESS.

SIR,—ST. 100 puts 5 XX on loud-speaker (2,000 ohms Junior Claritone) indoor aerial. Music loud, speech clear and strong. I think people who complain of 5 XX reception must be very inexperienced where tuning is concerned, or else their sets are not strictly to the book. The only difference between my set and your radio envelope is that I have used Sterling square law condensers.

Your MODERN WIRELESS loudest crystal set by Mr. Percy Harris works the same loud-speaker without any amplification whatever. In fact, we always have the loud-speaker on the crystal set now for the Savoy Band and just turn into bed and get fox-trotted off to sleep. We are two miles from 5SC.

Wishing you every success.—Yours truly,

F. T.

Glasgow.

To the Editor of MODERN WIRELESS.

SIR,—Having made up the crystal set described in the September number of MODERN WIRELESS, I should like to give a few reports of working of same.

Using a single wire 100 ft. aerial, 32 ft. high, Birmingham (7 miles away) comes in so loud that speech can be heard 12 ft. from an Amplion Junior loud-speaker. Using a loading coil Radio Paris and Chelmsford have both been clearly received on phones, as well as London, Cardiff and Bournemouth.

I consider that this is the best crystal set I have ever tried.—Yours truly,

H. BRAGG.

Solihull, nr. Birmingham.

A CORRECTION.

In the list of components for the "All Britain Receiver" described last month, 2—·0005mfds. variable condensers were specified This should read 1—·0005 mfds. and 1—·0003 mfds. as shown in the diagram, although 2—·0005 would work satisfactorily.

Notes on the Transatlantic Receivers

By
Percy W. Harris,
Assist. Editor.

So many receivers have been made up to the "Transatlantic" designs that a few notes on the subject may perhaps be of interest to those readers who are operating such instruments. The first "Transatlantic" receiver, using V. 24 and Q.X. (tubular type) valves of low capacity, was published in November last, while in the December issue followed a two-valve note-magnifier, using transformer coupling, designed to work with this set. Although remarkable results have been obtained with these instruments, many readers were desirous of building a five-valve receiver in which the ordinary four-pin valves were used, and in which the two units of high-frequency and detector, and note-magnifiers were combined in one. To satisfy these, the design known as the Transatlantic V. was published in the July number.

Many readers desirous of building the original three-valve Transatlantic have asked if it is possible to use any other types of valves, particularly as the V. 24 and Q.X. valves are rather greedy of current. It is not generally known that the dull emitting equivalents are obtainable as D.E.V. and D.E.Q., respectively. The D.E.V. and D.E.Q. can be substituted without any loss of signal strength for the V. 24 and Q.X. with substantial economy in current consumption. Another valve which will work admirably in this set and, incidentally, has a much lower first cost, is the Myers Valve.

Four-pin valves can be used in the original Transatlantic design, provided always that low-capacity sockets are used. The ordinary ebonite cased socket with long projecting pins and large brass nuts and washers will reduce the efficiency of the set considerably, and if it is desired to use four-pin valves, one of the many low-capacity valve sockets now available is strongly recommended.

So far as the Transatlantic V. is concerned this is designed, of course, for the four-pin valve, and here again it is essential that low-capacity valve sockets shall be used to give the best results. This remark applies, of course, only to the high-frequency and detecting valves. The low-frequency valve can have the ordinary type of socket. Great care should be taken to choose suitable valves for the high-frequency side. Dull emitting valves of the .06 ampere type can, of course, be used, but my experience is that in the high-frequency stages these valves do not give quite such good amplification as the bright emitters. For the note magnifiers I can strongly recommend in the first note-magnifier socket the D.E. 5 B. new valve, which at present is the only valve specially designed for resistance amplification. The amplification obtainable with this valve is remarkably high. The D.E. 5 B. valve, however, should not be used in the last stage, as it will only work satisfactorily in the fourth socket. For the last, one of the valves of the type known as the B. 4, or D.E. 5, serves admirably. Both the D.E. 5 B. and the B. 4 or D.E. 5 consume only a quarter of an ampere each.

Some Efficient Single Valve Reflex Circuits

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

This article forms chapter VIII. of the interesting series of articles which have been appearing in previous issues entitled "Reflex Wireless Receivers in Theory and Practice."

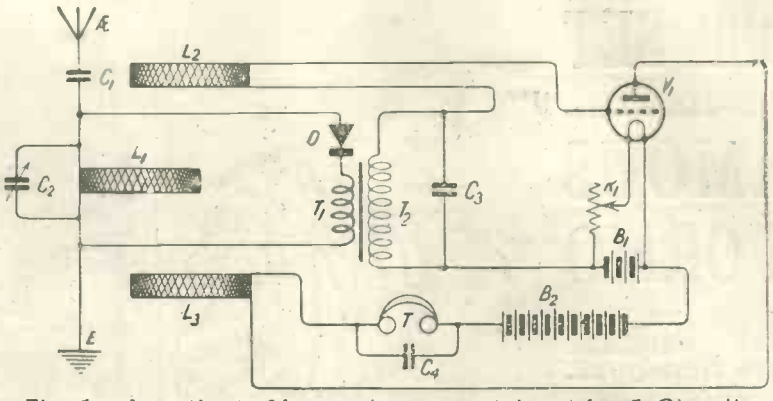

Fig. 1.—A method of improving a crystal and L.F. Circuit.

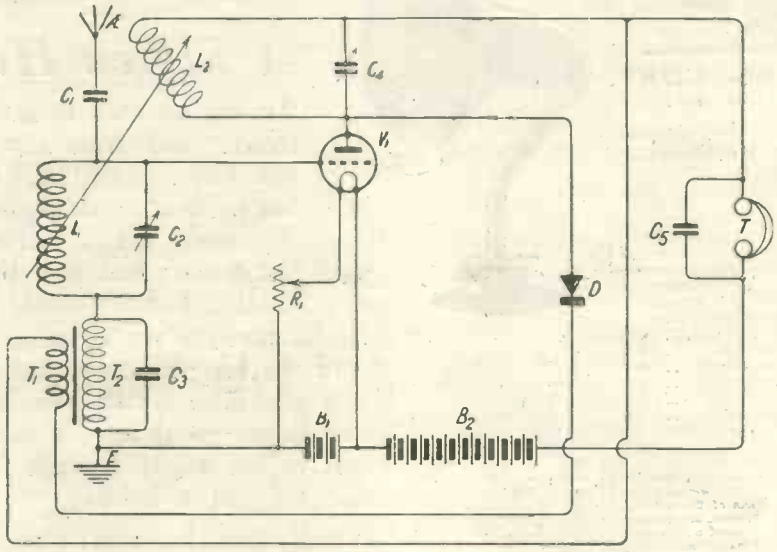

Fig. 2.—A useful single valve reflex circuit using C.A.T.

THE one valve user nearly always proceeds, via the reflex circuit, to the use of two valves. The single valve circuit is certainly ideal from the point of view of reflex working, because the troubles associated with this type of circuit vary as the square of a number of valves used!

Probably one of the first circuits using a single valve which the beginner employs is that in which a crystal detector receiver is used and the low-frequency currents, which would ordinarily go through the telephones, are passed to the grid of a valve through a step-up transformer and amplified.

Such a circuit may be greatly improved by using the valve, not only as an amplifier, but also as a means of introducing reaction into the aerial circuit.

Fig. 1 shows this circuit, and it will be seen that the usual crystal receiver, followed by a note magnifier, is employed. In the grid circuit of the valve is a coil L_2 coupled to L_1, while in the anode circuit of the valve there is another coil, L_3, coupled to the other side of L_1. These three coils are preferably of the honeycomb type, and for stations below 420 metres, L_1 may conveniently be a No. 50 coil, or a No. 75. These two coils will cover the ordinary broadcast stations, excluding 5 XX, which will require a No. 200 coil in the aerial circuit if constant aerial tuning is employed. For the ordinary broadcast stations L_2 and L_3 may be No. 50 coils, while if 5 XX is being received, the two coils may be of the No. 150

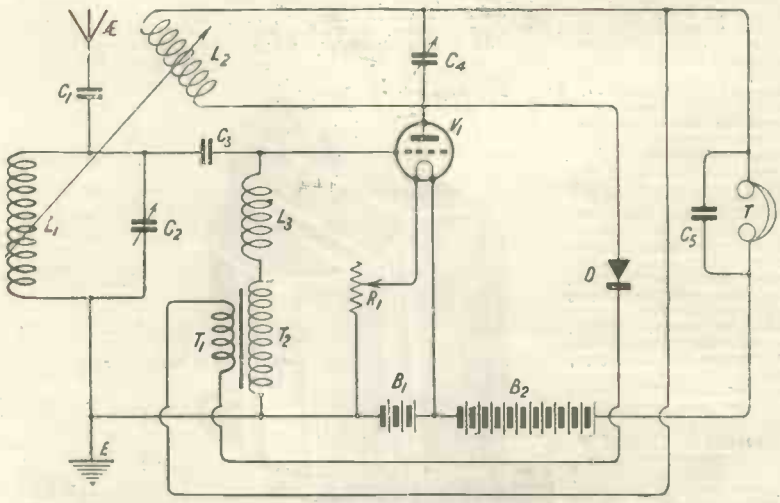

Fig. 3.—A choke coil method of feed-back which has certain advantages.

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.0005 mfd ..	9/6
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They are the *only* transformers suitable for use in tropical countries, or in countries where extremes of temperature are experienced. Made in ratios to suit every stage and position.

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B ratio 1-3. D ratio 1-5.

Also in 1-10 for use with high-tensionless circuits.

For the Myers Valve use B ratio.

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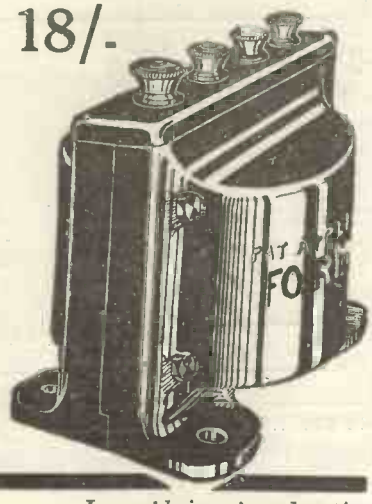

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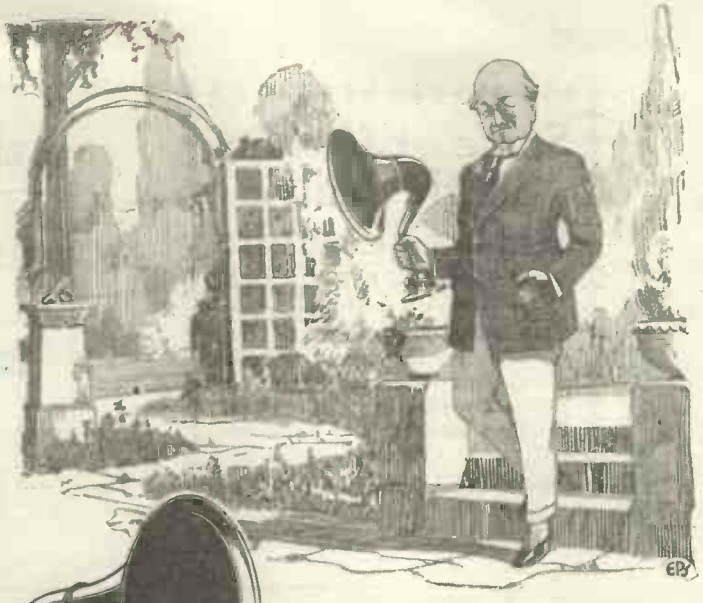

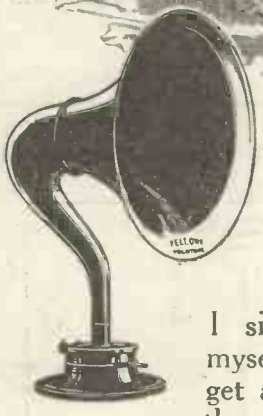

A Stolen Hour.

All the sweeter because it is stolen—and from my work, too. The so-called slack season has proved so successful that I simply don't get a minute to myself; it doesn't look as if I'll even get a holiday. I don't really mind, though; perhaps it's because of my record wireless Summer, but somehow a quiet hour or two in the garden after dinner—with my Volutone—seems to me easily enough recompense for just a holiday.

I'm really glad, however, we did produce the Volutone; the Junior is a fine little instrument, even better now we're fitting it with an adjustable diaphragm, but you do need something a little more powerful in the open air. You want to listen to a Volutone to appreciate how perfectly a modern Loud Speaker can give a large volume of sound without distortion. But more than anything I'm pleased about is its price. It really is

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size. If constant aerial tuning is not used, *i.e.*, if the condenser C_1 of .0001 μF is not included in the aerial circuit, the coil L_1 will require to be smaller and if the condenser C_2, instead of being in parallel with L_1 is connected in series with the aerial (C_1 not being inserted, of course), the aerial coil will have to be larger than the size used when constant aerial tuning is employed.

The coupling between L_2 and L_1, or between L_3 and L_1 will vary the reaction introduced into the aerial circuit, and it may be convenient to keep one coil tightly coupled to L_1 and vary the other. It is important to see that the coils are connected the right way round, and if a reverse reaction effect is obtained, the connections to one of the coils, either L_2 or L_1 (but not both) should be reversed.

Fig. 2 shows a useful single valve circuit using constant aerial tuning in which the valve acts as a high-frequency amplifier, the crystal detector D rectifying the amplified oscillations and the low-frequency currents being fed into the grid circuit by means of a transformer T_1 T_2. The condenser C_3 has a capacity of .001 μF; the variable condensers C_2 and C_4 may conveniently have a value of .0005 μF, while C_5 is the usual by-path condenser of .002 μF. Care should be taken to see that the reaction coil L_2 is connected the right way round, and reversing leads are desirable.

Fig. 3 is another single valve reflex circuit in which, however, the low-frequency currents are fed into the grid circuit through the choke coil L_3 which may be a No. 200 coil when ordinary broadcasting stations are being received. The condenser C_3 may conveniently have a capacity of .0003 μF.

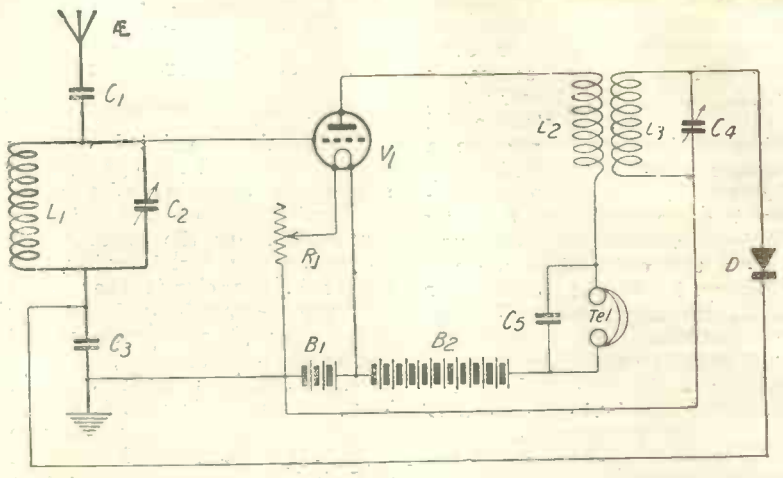


Fig. 4. A modified type of reflex circuit introduced by P. G. A. H. Voight.

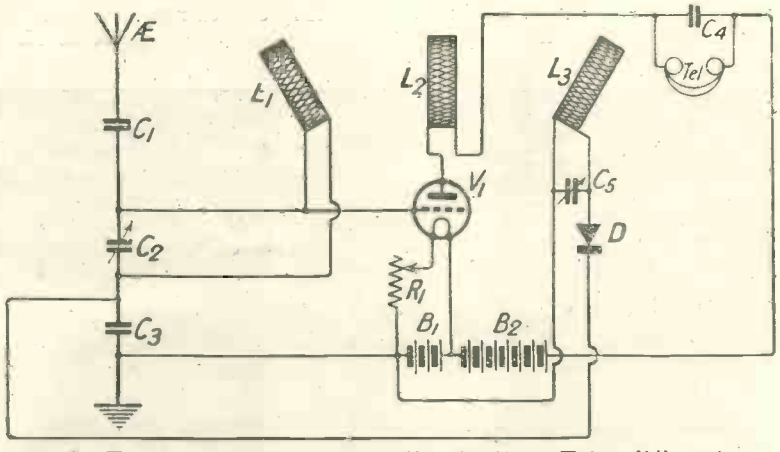


Fig. 5. The introduction of reaction by the "Tri-coil" system.

In Fig. 4 we have a reflex circuit of a kind popularised by P. G. A. H. Voigt. Constant aerial tuning has been employed and also my system of feeding the low-frequency currents into the aerial circuit, whereas the normal method would have been to have fed the low frequency currents into the condenser C_3 (which has a capacity of .0003 μF) between the earth and filament.

In all circuits where there is a condenser at the point where the low-frequency currents are fed into the joint aerial and grid circuits,

Fig. 3 is another single valve reflex circuit in which, however, the low-frequency currents are fed into the grid circuit through the choke coil L_3 which may be a No. 200 coil when ordinary broad-

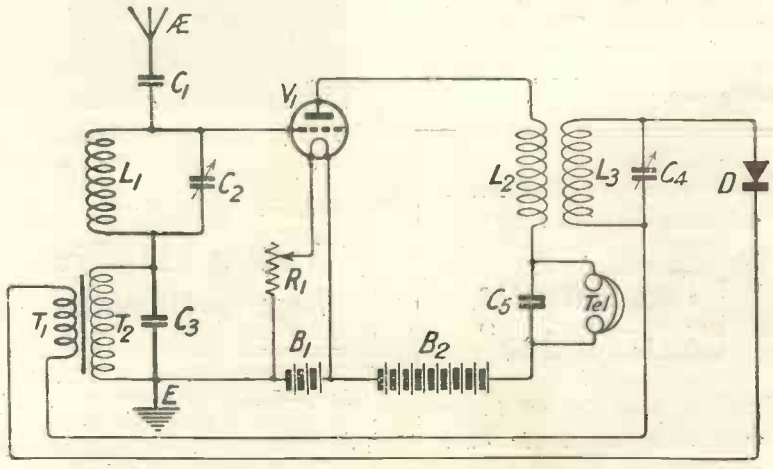


Fig. 6. An excellent type of circuit for the beginner.

it should be pointed out that the constant aerial tuning condenser may be much larger and may have a value of .0002 μF, or even .0003 μF. This, of course, is because the other condenser acting in series with the constant aerial tuning condenser will produce a resultant capacity approximately of .0001 μF. The Fig. 4 arrangement is quite stable and the only point which should be mentioned is that the connections to the secondary L_3 of the transformer L_2, L_3 are important. If they are connected the wrong way round to the crystal detector poor results will be obtained. No method of introducing reaction is shown in this arrangement.

Fig. 5 is a tri-coil circuit involving the tri-coil method of coupling, which I described in the September issue of MODERN WIRELESS. It will be seen that the general method of reflexing is the same as in Fig. 4, but that three honeycomb coils, L_1, L_2 and L_3 are employed. The anode coil L_2 is aperiodic and will usually be fairly tightly coupled to L_3, while L_1 may be brought up to L_2 for the purpose of obtaining a reaction effect. It is important to note that whenever the reaction is varied, all the tuned circuits should be readjusted.

Fig. 6 is a nice, quiet, well-behaved single valve reflex circuit in which no means of introducing reaction are provided. This is quite a good circuit for the beginner, and instead of using a plug-in transformer for L_2, L_3, two separate honeycomb coils may be employed. To obtain a reaction effect, the tri-coil method may be applied to this circuit as described last month. If the reader desires to make up this circuit he cannot do better than follow the instructions given last month by Mr. Percy W. Harris. The coils L_1, L_2 and L_3 are now mounted in a three-coil holder, the coil L_2 being the middle one.

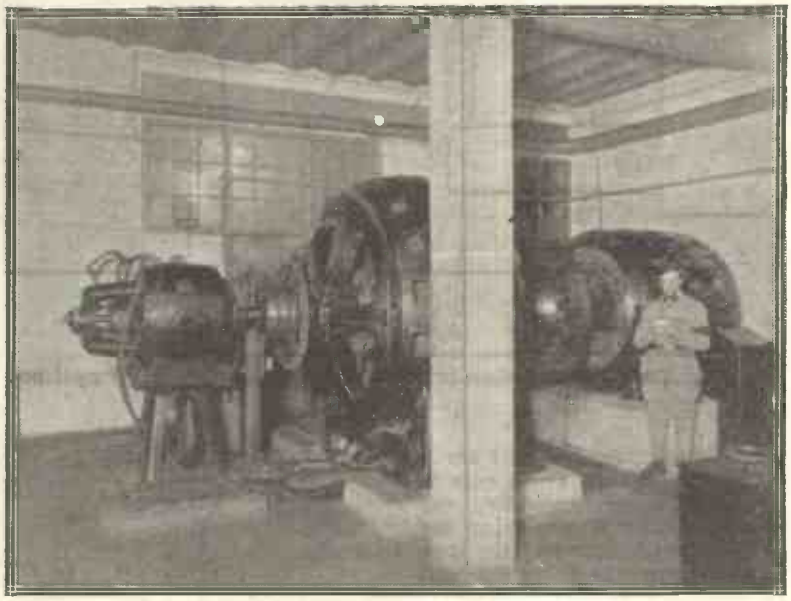
An Experimenter's Tuner

A further note

It has been pointed out by several interested readers that the scheme of switching adopted in the Tuning Unit which I described last month has the effect of so connecting the aerial tuning condenser in the circuit that when in the parallel position the moving plates are connected to aerial and the fixed plates to earth, and this arrangement has been queried. The explanation is that I have a personal preference for the use of the aerial condenser in series, as I find that this suits my own particular aerial and earth conditions, and I therefore arranged the switching so that when the condenser was in the series position, hand capacity effects were minimised. In parallel, of course, hand capacity effects are reduced by connecting the fixed plates to aerial and the moving ones to earth, and if the reader finds that he prefers the parallel position, it is a simple matter to reverse the two leads which are connected to the two terminals upon the aerial condenser. The secondary condenser is already arranged with the moving plates on the low potential side.

Enquiries have also been received as to the use of verniers and other means of fine adjustment in this tuner, and it should perhaps be explained that they were not fitted upon the original instrument because I am no very great believer in their use upon the normal wavelengths, but of course this is purely a matter of taste. The only possible objection to the use of vernier plates upon the variable condensers is that they in some cases make it rather difficult to calibrate the circuit accurately. Upon the really short wavelengths, no doubt, verniers would be of real use, and there is no reason why they should not be fitted.

G. P. K.



The photograph shows part of the musical spark equipment at the Eiffel Tower station.

A note on "An efficient Single Valve Receiver"

To the Editor, MODERN WIRELESS.

SIR,—I hope I am not wasting your valuable time in writing you, but having a few components at hand I constructed the single-valve set described by Mr. H. K. Simpson in the June edition. Using Igranic coils Nos. 50 and 75 and constant aerial tuning, reception was exceedingly loud and clear. Manchester was too loud for comfort on head-phones. Liverpool relay as good as Manchester. Birmingham comes in clear but is apt to fade. Last Friday Glasgow came in exceedingly well and clear. Other stations I have not tried for. Wishing MODERN WIRELESS every success.—Yours truly,

T. T. KEARNS.

Service Department Notes

The Month's Experiences.

THE principal feature of this month's experience in the Radio Press Service Department has undoubtedly been the extraordinary rush of work which came in at the outset of the month, and led to a somewhat congested situation. It seems that our readers realised what an inestimable boon the Department could prove in their difficulties, and the result was a flood of sets against which the useful new section had a hard struggle to make headway. As rapidly as possible new and much larger premises were secured, with room for a larger staff, and the services of Mr. W. R. H. Tingey (late of Tingey's Wireless, Ltd.) were secured to take charge of the actual testing work. With the aid of an augmented staff and the larger premises the arrears were rapidly caught up, and at the time of writing sets are being returned to their owners within a period of about two days.

The New Premises.

The new premises are No. 2, Melbourne Place, Aldwych, this situation being between Australia House and Bush House. These premises have in their turn proved inadequate to cope with the actual testing work itself, and this has now been transferred to an address considerably farther out of town in order that proper long-distance tests can be done. The actua receiving of sets and interviewing of their owners is still being done at the above address.

Sets sent in by rail or carrier should also be addressed to Melbourne Place, and their owners are urgently requested to label them as prominently as possible on the outside with their own name and address in order that sets may be readily identified as soon as received. Receipts are given for every set which comes in, either by post or personally, and this routine will be greatly facilitated if readers will kindly observe this rule as to labelling.

A Difficulty.

A good deal of difficulty has been experienced during the month of September with sets which have arrived with very serious modifications from the original designs, and we give once more our warning that we can accept no responsibility for the results given by such sets, and, moreover, that where the deviations are really serious we cannot undertake to perform the usual test. It has, of course, already been announced that we cannot deal with sets which have not been made up to Radio Press designs. It should be explained that by "a design" we mean a constructional article in one of our papers, a description in one of the Radio Press "How to Make" books, a Radio Press Envelope, Panel Card, or Simplex Chart. The following of a circuit diagram is not alone sufficient. It is necessary to announce further that we cannot undertake to test receivers which have not been made up by our readers themselves, but have been constructed for them by someone in the wireless trade. We must emphasise that we cannot undertake to advise members of the wireless industry, whether upon the operation of the set or upon such questions as the payment of royalties, patent rights, etc.

We receive a considerable number of queries upon these points, and

The picture reflects the impressiveness of Bush House, where the new offices of Radio Press are situated.

these should rather be addressed to the appropriate quarter, namely, the owners of the patent rights concerned. One or two readers have raised the question of the exact amount of work which is done upon any given set under test for the standard fee, and possibly a few words of explanation upon this point may be of assistance. Our standard fee is 2s. 6d. per valve in the case of multi-valve sets, a minimum of 3s. 6d. for a single valve set, reflex valves being charged as two, and the services covered by this fee are as follows. Upon receipt of the set, the wiring is carefully checked, all the component parts are then given an exhaustive electrical test, while the circuits are all tested for continuity, etc., and finally, after a number of intermediate tests, the set is, if possible, tested upon the aerial. If it is necessary to make any serious alterations to the set to put it in working order, a further charge is necessary, but this work is not embarked upon without the sanction of the owner. The ordinary course, then, would be simply to return the set to the owner, pointing out the faults which have been discovered, and leave him to correct them. Where a perfectly obvious fault has been discovered, such as a break in the primary of a low-frequency Transformer, this course is adopted, but there are a certain number of cases where it is not possible to say definitely that all the faults have been discovered until one or more of them have been corrected and the set re-tested upon the aerial. For example, a badly-soldered joint in the wiring may require re-soldering, and possibly a faulty connection may have to be corrected. Where, therefore, an alteration is necessary in order to satisfy ourselves that all the faults have been discovered this is done as a part of the test. In all other cases a further charge would be made if any actual alteration had to be done.

The faults reported upon this month have all been of a more or less straightforward nature, and there is little to justify comment. One or two constructors of the Simplicity Three-Valve Set (Radio Press Envelope No. 3) appeared to have had a little difficulty in winding the fine wire upon the anode coil, and constructors will be glad to know that these coils can be purchased ready wound for use in this particular receiver from a number of the advertisers in MODERN WIRELESS. Further, one or two constructors have had trouble in obtaining the correct size of ebonite tube, and here they are referred to the firms who advertise the complete sets of parts for Radio Press receivers.

The Radio Press Wireless Panel Transfers.

THE Radio Press Panel Transfers have met with an immediate and enthusiastic welcome from beginner and experienced constructor alike. This is not perhaps surprising when one remembers the great variety of the labels included in the set, the secure packing in which they are sent out, and the very low price of 6d. at which they are sold.

These transfers can be bought from any bookseller or dealer, or direct from Radio Press, Ltd. When ordering direct from these offices please allow a further 3d. for postage and packing.

Trouble Corner

By ADSUM

How to Test Fixed Condensers at Home

Testing Fixed Condensers

THERE is, I suppose, no component on the market at the present time over which the wireless man is so apt to get done as the fixed condenser. If condensers of well known and reliable make are purchased it is unlikely that trouble of any kind will occur; but it often happens that when one requires a condenser in a hurry and purchases it at some local shop, that the only kind available is one of the nameless makes about which no information is available except that it is "guaranteed (we are not told by whom) to be of the capacity stated." These things may or may not be good. There is really no reason why perfectly efficient fixed condensers should not be produced in quantities at a small price. More often than not they are unsatisfactory in one of three ways: the capacity may be anything but what it is stated to be, there may be a disconnection —or even no plates at all!— within the case, or there may be a short circuit whose presence will lead to disastrous results if the condenser is used for blocking purposes. It is impossible to test the capacity of a condenser accurately unless some such precision instrument as a capacity bridge is available, but a very fair idea can be obtained by the simple method shown in Fig. 1. Wire up the circuit consisting of plug-in coil, a crystal detector and a pair of telephones. In parallel with the inductance place a good quality condenser C, Fig. 1 whose value is known to be approximately that given for the one to be tested. With the aid of a wavemeter, measure the wavelength of the circuit. Those who do not possess wavemeters can usually manage to borrow them from some obliging friend, or the test may be carried out in the wireless den of a friend who is well provided with apparatus. Now remove the condenser C and connect up in its stead one whose capacity you desire to verify. Measure the wavelength as before. If the reading obtained is approximately equal to that given when the first condenser was used then there is nothing wrong with the capacity. If, however, it should have been considerably overstated it will be found that the wave-

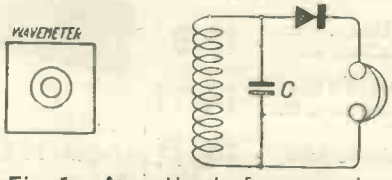


Fig. 1.—A method of comparing capacities by substitution.

length reading is very much less than it was in the first instance. In the same way a greater wavelength will show that the condenser under test has an excessive capacity. Should it be found quite impossible to obtain even the loan of a wavemeter the circuit shown in Fig. 2 may be used. Here L_1 and L_2 are plug-in coils whose sizes will depend upon the capacities of C_1 and C_2. In series with L_1

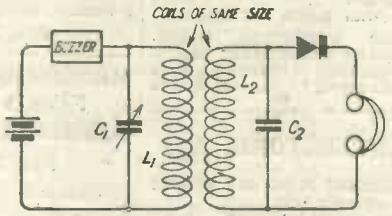


Fig. 2.—An alternative method to that of Fig. 1.

is a small buzzer and a battery, the coil being shunted with a variable condenser C_1. Carry out the test in just the same way as before, placing first of all the known fixed condenser in the position marked C_2 and note the scale reading of C_1 which gives the loudest buzz in the telephones. Then connect up the condenser under trial and compare the two readings of C_1.

Testing for Disconnections

An excellent test for disconnections in a condenser can be made in the way shown in Fig. 3, with the help of a low frequency intervalve or telephone transformer. The telephones with the condenser under test in series with them are wired to the secondary terminals of the transformer and one end of a small battery is connected to one of the primary terminals. With a lead attached to the other end of the battery the vacant primary terminal is brushed rapidly. If the connections are as they should be, loud clicks will be heard in the telephones, since making and breaking contact in the primary circuit sets up current fluctuations which are transformed into an alternating current in the secondary. A condenser should pass an alternating current; the absence of clicks therefore denotes that the condenser has broken down inside. This test shows us simply that there is only no disconnection; it does not prove that there is no short circuit within the condenser.

Test for Short Circuit

We can test for this in the way shown in Fig. 4, by wiring the condenser, a small battery, and the telephones in series and touching the terminal of the condenser (X, Fig. 4) opposite to that connected to the battery with one of the phone leads. A short circuit will be denoted by the occurrence of clicks as strong as those which take place when the point Y is touched with a phone lead. With small condensers that are in good order no clicks at all should be heard, though with those of larger size faint clicks may occur which are due to the charging up of the condenser

(*Continued on page 566*).

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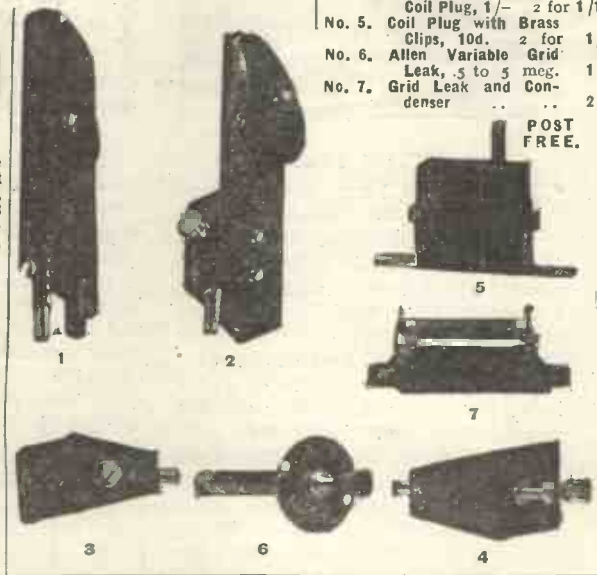

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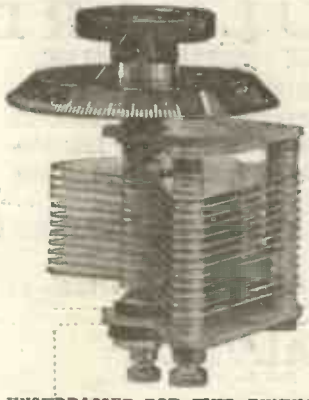

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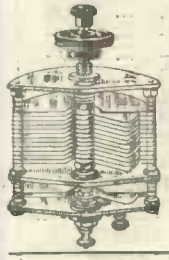

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when contact is made. Without being actually short circuited the condenser may be leaky, that is it may be incapable of holding its charge properly. For this fault a test may be made as shown in Fig. 5. The condenser is first charged up by placing it for a few seconds across a portion of the high tension battery. The

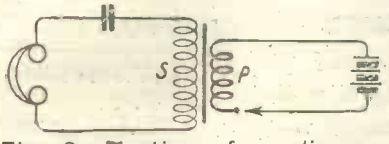


Fig. 3.—Testing for disconnection in a condenser.

battery is then removed and the condenser contacts are touched with the phone leads B, (Fig. 5) the strength of the click given being noted mentally. The condenser should now be charged up again as before and left for ten minutes. If it fails to give any click at all at the end of this time leakage is taking place. Even a faint click shows that the condenser is in good order, whilst if a loud one is obtained it may be passed as a first-class component. Whenever the process of tracking down a fault in the receiving set leads one to suspect any of the condensers it should always be tested at once for a disconnection as well as for a short circuit.

Bad Ebonite

I referred in these notes a short time ago to the case of a receiving set which failed entirely to function on account of the poor insulation provided by the panel upon which the components were mounted. In this case the root cause of the trouble was found to be the presence between the valve legs on the underside of the panel of a messy coating of flux in which were tiny pieces of solder and chips of brass. Tests have shown that fluxite is in itself a non-conductor, in fact with a small megger an "infinity" reading is obtained between wires embedded in it. Its insulating qualities however are changed by heat. Now fluxite serves as an admirable resting-place for dust, whose presence leads to the formation of a conducting layer. The greatest care should always be taken to keep panels free from all stickiness. The best way of ensuring this whilst soldering is to place a piece of blotting paper on the shank of the terminal or valve leg which is being dealt with to act as a catcher for splutterings.

Leakage, however, may occur between terminals mounted upon perfectly clean panels, even if the polished surface has been properly removed with emery and fine glass paper. As ebonite is sold by weight there is a strong temptation to such manufacturers as have no reputation to maintain, to "load" it with various heavy substances, whose presence is apt to impair its insulating qualities. With ebonite such as this considerable leakages may occur, which will produce rather mysterious symptoms in the receiving set. If the set is found to be noisy though its grid-leaks, condensers, valves and high-tension battery give good results when tried on other receivers, the trouble is very probably due to faulty panel insulation. Another symptom is a marked flatness in the tuning of circuits, and self-oscillation may also be present. When these things occur the panel should always be tested out with the help of the telephones and the high-tension battery in the way shown in Fig. 6. Attach the

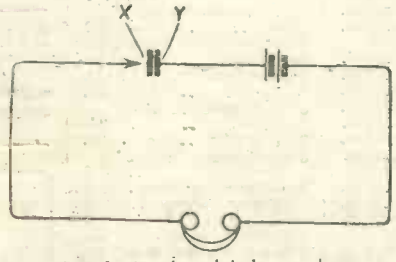


Fig. 4.—A test which makes a short circuit evident.

positive of the battery to any terminal and connect one of the telephone leads to its negative end. With the other lead touch the ebonite surface in various places. If tiny clicks are heard when contact is made then there is a leakage and the panel will never be satisfactory. Several terminals should be tried in different parts of the panel and valve holders should be tested in the same way, for it may be that there is one small faulty patch which is causing all the trouble. The telephones respond to such minute currents—a tiny fraction of a microampere is sufficient to produce audible clicks—that very slight leakages are easily discovered by the method described. When making up sets or small pieces of apparatus it is always as well to test out the ebonite for leakages after drilling has been done. One or two terminals may be inserted in the holes made and tests carried out as described.

Variable Grid-Leaks and Resistances

A good deal of trouble may be caused at times by variable grid-leaks or anode resistances. One of the worst outbreaks of noisiness that I have ever known on my own set was traced eventually to a variable anode resistance. The majority of these have a threaded collar at the top through which passes a plunger which is screwed down by turning a knob. Should the thread of the plunger be a loose fit, as is not infrequently the case, in the collar, then look out for squalls, or rather for ear-splitting crackles due to the uncertain contact provided. Before fitting a variable resistance of this kind always see whether the plunger is at all shaky in the collar and do not purchase one which has this defect. Should resistances which are already in position on the set prove noisy try the effect of pressing the knob from side to side whilst the set is working. A chance contact will be shown up by a perfect fusilade of crackles of the most violent type as you do so. There is unfortunately no cure for a resistance which is faulty in this way unless you are the fortunate possessor of a screw-cutting lathe and can make a new plunger with properly-cut thread which will fit the collar tightly. The same fault may be the cause of noisiness in grid-leaks. In both these and anode resistances crackles are usually at their worst when the resistance has been adjusted to a pretty high value. Another fault which may develop in either is packing. The majority of resistances of both kinds are filled with carbon discs which are pressed together as the plunger is screwed down. When the component is new these discs come apart readily as the pressure is reduced by unscrewing the plunger, but after it has been in use for some time the discs do not separate but remain stuck together. The result of this is that there is very little difference, if any, between the maximum and

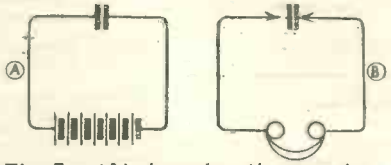
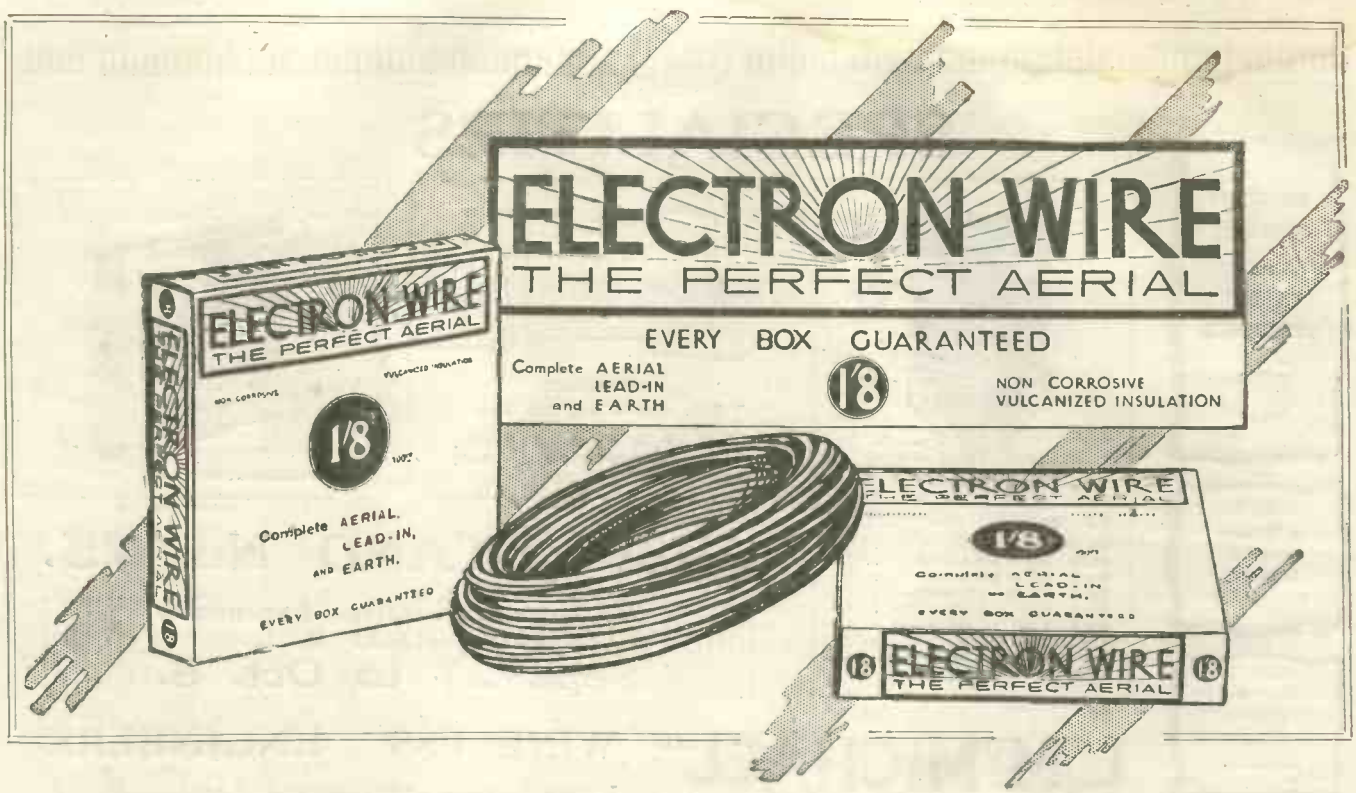


Fig. 5.—(A) charging the condenser and (B) testing for leakage.

minimum resistance obtainable, so that you may imagine that you are working with a grid-leak of 4 megohms or a 100,000-ohm anode resistance when really their values may be respectively only .5 megohm and 20,000 ohms. Should you suspect that packing is taking place it is best to take the resistance to pieces, which is



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not as a rule a difficult job, and to separate the carbon discs, afterwards rubbing them over with a piece of fine emery cloth.

Demagnetised Phones

It happens not infrequently when high resistance telephones are used with valve sets that there is in time a distinct and an apparently quite unaccountable falling off in signal strength. This is due in most cases to the demagnetisation of the permanent magnets of the receivers which takes place through their being wrongly connected to the telephone terminals of the set. Most good makes of telephones and loud-speakers have one terminal marked positive or one lead bound with red silk at its end. The greatest care should always be taken to attach this to the telephone terminal which is connected direct to high-tension positive. If the connections are reversed the normal steady current passing in the plate circuit of the last valve, which may amount to two or three milliamperes, flows round the windings in such a direction that it opposes the permanent magnets which in time lose

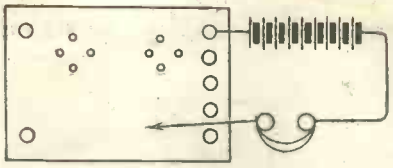


Fig. 6.—Testing for panel insulation.

their strength. When the positive lead of the telephones or the positive terminal of the loud-speaker is not marked it can usually be found quite easily. Unscrew the cap and remove the diaphragm. Now lay a steel watch chain on the table and see how many of its links the permanent magnets can lift. Next connect the phones to the set and see whether the lifting power is increased or decreased when the filament battery and the high-tension battery are switched on. If it is slightly increased current is flowing in the right direction, but if there is a decrease then the connections should be reversed.

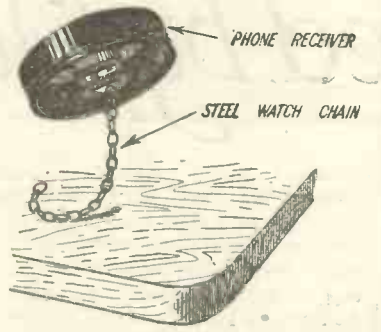
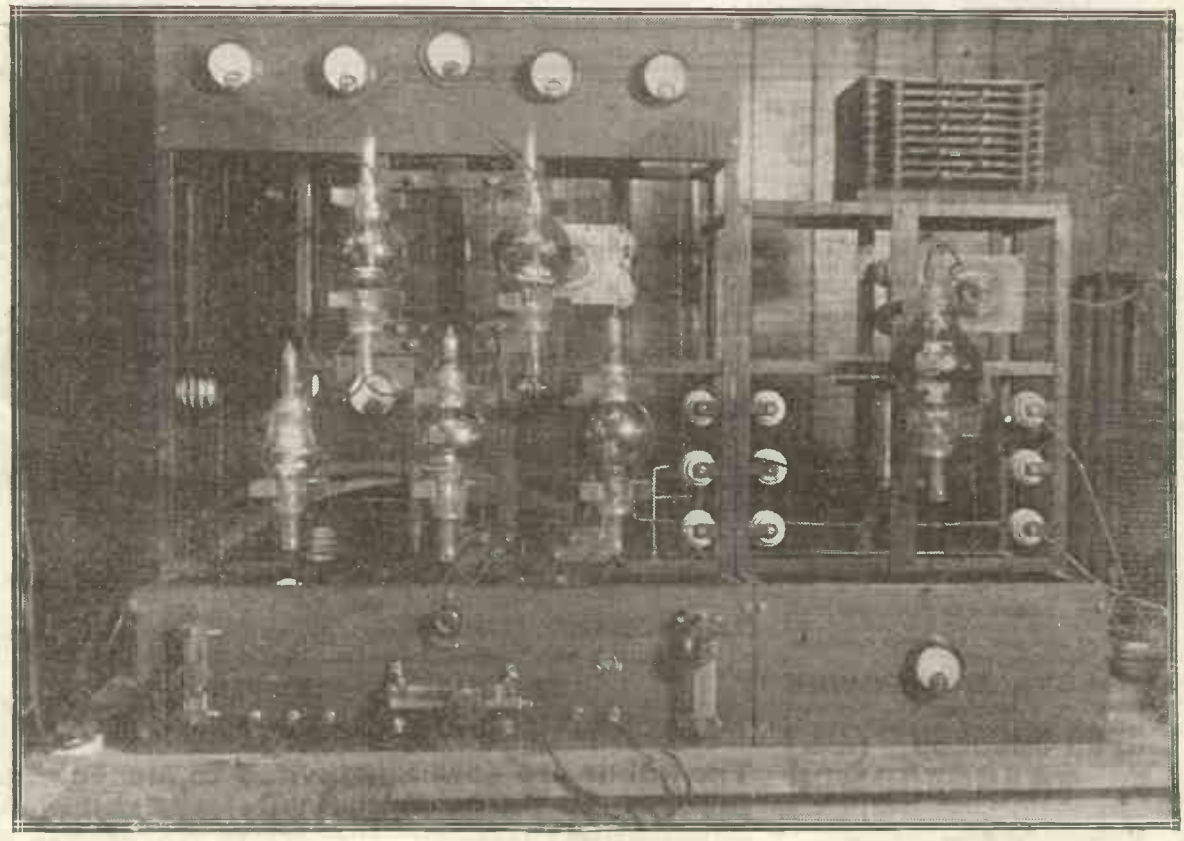


Fig. 7.—A test to determine the correct way of connecting telephones.



A photograph showing the transmitting apparatus at the Edinburgh Station.

Tested by Ourselves

A Multiple Connecting Cable

THE usual unsightly tangle of wires connected up to a radio receiver can be reduced to something much more orderly with the aid of such a multiple connecting cable as the "Easifix" 4-way multiple cable of Messrs. Ward and Goldstone, a sample of which has been submitted for test. In this all four leads from the set to the H.T. and L.T. battery are enclosed in a common cable, covered in black fabric. At the near end this branches out into four single connections, distinctively coloured, and fitted with neat spade terminals to go on the terminals of the set. At about a foot from this end the two H.T. connections branch out, each provided with a wander-plug suitably coloured. At the further end the two coloured L.T. leads separate, and are fitted with similar spade-terminals for connecting to the accumulator. As the whole cable is just over a yard long, the accumulator can be placed on the floor out of the way.

The effect is extremely neat and workmanlike; and the distinctive colour scheme should avoid many of the disasters which follow wrong connections. The price is very reasonable and the device can be recommended to all who like their sets to be neat and efficient.

Formo Variable Condensers

A couple of samples of the (nominal) .0005 μF size of variable condenser, a larger size of which has already been reported on in these columns, have been submitted by Messrs. Formo Company.

The general design is similar to that of the larger type, the plates being corrugated in V form, giving greater rigidity and a larger capacity for a given size than with the more usual flat plates; and it is fitted with a one-plate "vernier" or fine adjustment concentric with the main portion of the condenser, controlled by the same knob by a sliding clutch motion. When adjusting the "vernier" the main bank of plates is left at the adjustment already made, by the action of this clutch, the knob being merely depressed or released to engage and disengage the clutch.

On trial, the action of the condensers was found smooth and silent, the vernier device being very convenient. The insulation resistance with the 500-volt D.C. "Meg" tester proved excellent. The one condenser had the satisfactorily low minimum of 15 micro-microfarads—about 4 per cent. of the maximum only—the actual maximum capacity being .00038 μF, and the vernier giving a range for fine adjustment of 44 micro-microfarads. The second instrument showed a maximum of just below .00038 μF.

The workmanship, finish, and the mode of mounting of these were similar to that of the larger condenser already reported. This firm should immediately remedy the design so as to give the full capacity claimed for their condensers.

Gerrard Variable Condenser

An original type of variable condenser, with "vernier" attachment, is that supplied by the Gerrard Radio, a sample of which, of the 1/1000 micro-farad size, has been submitted for test. In this two plates only are used, each of semi-cylindrical form, an almost incredibly small air-gap being attained between these by very careful workmanship and accurate mounting in substantial bearings, in a cylindrical case, partly of transparent celluloid, arranged for mounting beneath the panel by means of small screws. The "vernier" effect is obtained by a separate circular plate advanced towards or withdrawn from the flat end of this cylindrical case, by means of a micrometer screw concentric with the main spindle. A bevel scale and two concentric knobs provide the control.

The finish of the instrument was very fine and the appearance attractive. For a condenser of this size the dimensions were noticeably small. The action in actual reception was smooth, tuning of the finest kind being attained with the vernier device. The maximum capacity came out at .00090 μF, the minimum being the surprisingly low figure of 33 micro-microfarads, *i.e.*, only 3½ per cent. of the maximum. The vernier gave a range of .000015 μF for fine tuning. With the plates clear of one another, the insulation-resistance on 500 volts D.C. was good, showing that the insulating bushes, etc., were of good quality. With the plates engaged any distance, whilst for H.F. currents and small voltages no fault appeared, on the "Meg" tester and even on the H.T. battery, the insulation immediately broke down, sparking taking place across the minute gap between the plates. With this limitation, this type of compact variable condenser appears to us to have attractive possibilities.

A Geared Variable Condenser.

An interesting type of variable condenser, in which a two-to-one

gear is incorporated so that the whole 360 degrees of the circular scale are available, and the control is made proportionately the more delicate, is the "Fulstop" condenser, a sample of which of the .0002 μF size has been sent for test by J. H. Naylor, Ltd.

This instrument has single-hole fixing, a $\frac{5}{16}$ in. hole in the panel being needed. It is 2 in. deep below the panel, and occupies a circular space of about $3\frac{1}{2}$ in. diameter. A circular bevel scale of double degrees (180 divisions in the whole circle, to correspond with the usual semicircular scale) with knob are provided, and an aluminium disc as guard-plate and zero-indicator just under or over the panel. This, together with the operating spindle and gear-mechanism, are to be earthed, an earthing-tab being provided for this purpose. As a result, the hand-capacity effects practically vanish, making fine-tuning an easy task.

The 13-plate condenser coupled by an ebonite bush to the slow-speed shaft is of usual pattern. Connections are made by substantial and convenient terminals on the ebonite end-plate, that to the moving spindle being maintained by spring pressure.

On trial, the instrument operated with delightful ease and smoothness, extremely fine tuning being possible without a vernier attachment. Effects of back-lash in the gearing were not noticed. The minimum capacity was about 7 per cent. of the maximum, the latter coming out at .000212 μF.

We can strongly recommend this type of geared condenser for careful tuning, and for use in situations where hand-capacity effects are troublesome. The finish, workmanship, and insulation-resistance (on 500 volts D.C.) were excellent.

Fellow Junior Loud-Speaker

From Messrs. Fellows Magneto Co. comes a sample of their "Fellow Junior" loud-speaker, an inexpensive type of moderate size and power. This is of the usual vertical pattern, with a plain black finish. In that submitted there was no adjustment device for the magnets, but we understand that this is to be fitted to future patterns.

On trial, though not powerful, and apt to give signs of a slight rattle or harshness when overloaded, the tone was much purer than is sometimes found in even expensive loud-speakers, the tendency being towards a higher "pitch" rather than that hollow resonance which is sometimes admired as "mellowness."

Amplion Junior Loud-Speaker

Messrs. Alfred Graham and Co. have sent for trial an example of the new pattern "Junior Amplion" loud-speaker, of 2000 ohms resistance.

This resembles the older type fairly closely in outward appearance, the same type of inclined short trumpet and stand being used, but it is equipped with the "floating diaphragm" for which special claims for undistorted reproduction are made, the diaphragm being flexibly supported around the edge instead of being clamped down tightly. Certain diaphragm resonance phenomena are stated to be minimised by this mode of mounting the diaphragm. Peculiar terminals with a left-hand thread and a stop to prevent loss of the nut are used on the instrument. The usual adjustment of the magnet is provided.

On trial, with a receiver unusually free from distortion, it was noticed that this loud-speaker was very powerful for its size and price, giving a large volume of sound on two valves. The tone represented

a noticeable improvement over the older pattern, though rather "low-pitched."

L.F. Transformer with Fixed Condenser

Messrs. L. McMichael and Co., Ltd., have sent for test one of their small L.F. intervalve transformers, similar to the type reported on recently in these columns, but with permanent clips mounted on the top in which can be fitted, across the primary winding, one of the convenient pattern of fixed condensers marketed by this firm. The general construction and finish were of the same order as before. The terminals we noted are marked "H.T.+," "A," "Com.—" and "G," so that the home-constructor may know how to connect it up. Useful double-purpose terminals which take either a straight-wire-end or a spade-terminal with equal security are also fitted. The insulation resistance from primary to secondary and from secondary to core was satisfactory; the primary winding is apparently permanently connected to the core, to avoid instability in several-stage amplifiers. On actual trial, as with the former small transformer, the actual amplification attained was not high, but there was very much less distortion than is usual in small moderate priced transformers.

Valves for Power Amplification

Messrs. Edison Swan Electric Co., Ltd., have submitted for test samples of three new types of small power valves, suitable for use with high plate-potentials in "power amplification."

The type P.V. 3 has the most modest requirements in the way of filament current and plate voltage: the valve tested took .8 amperes at 4 volts for filament-lighting, and was rated at 70 to 110 volts H.T. Tested under these conditions it gave an interesting characteristic curve. Eight milliamperes of plate current, with a fairly long portion of almost straight character around zero grid volts, suggested good distortionless amplification with only sufficient grid-bias to avoid grid current under working conditions: practical trial confirmed this, about 3 volts negative being found sufficient bias with normal value of H.T. Excellent loud-speaking resulted, whilst handling a R.M.S. value of final signal-voltage of about 2 volts. The A.C. impedance is naturally pretty low: only 10,000 ohms; whilst the amplification-factor is about what one would expect in a power-stage valve, 4.7 approximately at 110 volts H.T. and zero grid volts.

The valve has a fairly large vertical tubular anode, and is largely obscured by a metallic mirror formed in the "cleaning-up" process.

For general use in a loud audio-amplification stage this valve can be strongly recommended; and will certainly give far better and purer results than a small R-valve of limited filament-emission in loud-speaker work, if used with proper grid-bias.

The types P.V. 1 and 2 both take a considerable amount of power for heating the filament, as well as requiring high plate-voltage: in return for which they are able to handle very large amounts of signal-energy without introducing distortion due to partial rectification on the bends of the characteristic.

The P.V. 2 is rated at 200 to 400 volts H.T. Tested at the former rate it showed no less than 14 milliamperes plate-current at zero grid volts, with 1.5 ampere and 6 volts for filament-lighting. There were no signs of saturation at a plate-current of over 25 milliamperes; and the characteristic was remarkably straight over a large range. The amplification-factor worked

out under these conditions at the satisfactory figure of 7; the A.C. impedance was low: 10,000 ohms. On practical trial with 200 volts on the plate as a second-stage power-amplifier, handling very powerful signals (R.M.S. value around 2 volts in preceding stage, *i.e.*, good loud-speaking already) the result was freer than usual from the characteristic distortion due to partial rectification, but indicated that the higher plate-voltage for which the valve is designed (400 volts) would have been desirable. This was with 6-10 volts negative grid-bias. With less powerful signals the result was very pleasant.

The valve has a horizontal anode of fairly large size, and is but slightly obscured. The supports of the electrodes are particularly sturdy.

Type P.V. 1 is an extremely powerful valve which might be described as a small transmitter-valve, though of similar build to the P.V. 2; the plate being of rather larger dimensions. It is rated at 300 to 600 volts H.T. With 1.5 ampere in the filament and 6 volts across it, and the highest available plate-voltage of 223 volts, the characteristic curves obtained indicated a remarkably straight characteristic, an unusually high amplification factor (due to the geometrical arrangement and relative dimensions of grid and plate) of 12; but indicated as was to be expected that much higher plate-voltage was required in order to attain good working conditions for distortionless amplification of powerful signals. It was evident, however, that excellent results were to be expected when worked under the conditions specified by the makers, and with ample negative grid-bias.

With both these types, P.V. 1 and 2, there were no signs of softness with the highest available H.T., and they were free from valve-noises in operation. Used strictly in accordance with their rating, and with plate-voltage adjusted in relation to the signal-energy handled, they can be recommended for use in real power-amplification. It should be noted that the heavy plate-currents demanded even with adequate negative grid-bias are beyond the power of the usual type of small H.T. battery, which would soon become noisy in use.

Note on "A Crystal Set"

In response to many readers' queries as to the amount of 16 gauge D.C.C. wire required for the above set. 1lb. will be found ample.

Are You Troubled By Interference?

IT would be interesting to know the percentage of broadcast listeners-in in this country who never hear anything but the desired speech or music when tuned to their nearest broadcasting station. Coast dwellers are the chief sufferers from interference owing to the large amount of spark telegraphy carried on between coastal and ship stations. The very flat tuning of many spark transmissions renders them extremely hard to eliminate or even to reduce to negligible strength,

We have also the interference caused by a nearby broadcasting station when it is desired to tune in another station on a slightly different wavelength. In such a case it is impossible to receive the desired station to the entire exclusion of the local station unless a really efficient tuner is employed.

In the September 3rd and 10th issues of *Wireless Weekly* Mr. G. P. Kendall, B.Sc., fully explained the use of a number of loose-coupled circuits for use where the utmost selectivity is sought.

No reader who is harassed by spark telegraphy, or is unable to enjoy the transmissions of distant stations owing to local interference, can afford to have missed this article.

In the September 3rd issue was described an efficient resistance-coupled three-valve receiver which will appeal to those who wish to get maximum purity of reproduction.

The construction of a two-valve receiver consisting of a detector and a note magnifier is fully described in the issue for September 10th. This is a particularly good arrangement for loud-speaker work near a main station or for 'phone work at a distance, since little difficulty is met with in tuning.

An exceptionally interesting article, entitled "American and British Radio," appeared in the September 17th issue, in which some surprising facts are brought to light. "A large range two-valve Receiver," which will interest those living at a distance from a broadcasting station, was also described.

Mr. J. Scott-Taggart's Valve Notes for September 24th contain some further interesting facts concerning the Cowper Neutrodyne arrangement, with which he has been experimenting recently with great success.

(Continued from page 525.)

advantages of the arc system is that it produces a great variety of undesirable harmonics. Most of those who used to sit till the small hours of the morning in past winters listening for American signals will have a full experience of the harmonic "mush" produced on the shorter waves by both Leafield and Northolt. Lately, however, it has been greatly reduced.

Valve Circuits

It will not be necessary to give any account of valve transmitters since these are becoming the most

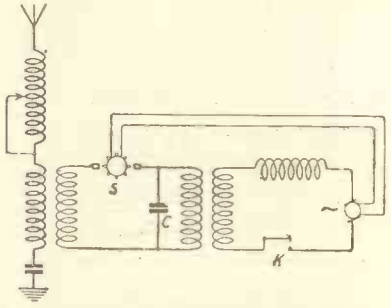


Fig. 4.—The Marconi synchronous spark transmitter circuit.

commonly used and the best known of all. The valve is an efficient generator of high frequency oscillations and has the great advantage that it can be used equally well for any frequency from the lowest to the highest. The arc system, on the other hand, reaches its highest efficiency on long waves, and is of comparatively little use on wavelengths much below 2,000 metres. The valve is rapidly replacing all other methods, and probably the time is not far distant when either valves as we know them now, or some development of them, will be the only kind of oscillators in use for wireless transmission.

The High-Frequency Alternator

A very interesting system of transmission is that which makes use of a high-frequency alternator delivering current at a frequency suitable for radio work direct to the aerial. One of the best known systems is that developed by Mr. E. F. W. Alexanderson in conjunction with the Radio Corporation of America. In the early days of long-distance wireless telegraphy the inefficiency of both the spark and the arc systems was recognised, but it appeared for a time that no better means could be devised for producing alternating currents at the frequencies required. The generators used for power work gave from 30 to 100 cycles a second, frequencies which are obviously useless for direct application to wireless. Several pioneers, including Fessender, designed alternators that would deliver current at a frequency hitherto undreamt of. One of Alexanderson's earliest machines was a two-kilowatt alternator of 100,000 cycles. Later he installed a 50-kilowatt, 50,000 cycle, alternator at New Brunswick (WII), and this was followed by the two present generators at the station, both of which are rated at 200 kilowatts, 27,000 cycles. In this system the current from the alternator is fed directly into the aerial. The Alexanderson high-speed generator system of transmission is used at the Marconi station at Carnarvon, in many American stations, and has recently been installed at the Polish Government station at Warsaw (WAR). Another transmitting system making use of a high-speed alternator is the Goldschmidt, which is in use at the great German stations Eilvese (OUI) and Nauen (POZ).

Multiple System Stations

Many of the great stations nowadays make use of more than one system of transmission. The Eiffel Tower station (FL), at Paris, for example, is equipped with all four systems, spark, arc, valve, and high-frequency alternator, and the same is the case with several others. The spark transmitter is used chiefly for sending out time signals and weather reports. It is found desirable to retain this method since such a large proportion of ships are still not fitted with receivers capable of dealing with continuous wave transmissions. The other three systems are used for commercial work on various wavelengths, the valve system being, of course, employed for telephonic transmissions as well as for work on the very short waves. Concerts are given on special days from FL by means of the valve transmitter.

A Curious Problem

One has always seen it stated by the highest authorities in wireless that it is possible to make a telephone receiver too selective, since transmissions of this kind occupy not one wavelength but a small waveband of varying width. It is argued, therefore, that if an ultra-selective tuner is made distortion may arise owing to the tuning out of essential parts of the transmission. I was discussing this point the other day with one who can claim to be an expert of the first order, when he asked me if I was quite sure that telephonic transmissions were actually on a waveband rather than on a wavelength. I confess that I have always accepted without question the conclusions of experimenters who are better acquainted than I am with the mathematics of wireless theory. Mathematically it is, I believe, possible to demonstrate that transmissions must take the form of a narrow band, but from the point of view of practical wireless reception it is a little difficult. Certainly I have never found noticeable distortion even when using as many as four sharply tuned circuits in a receiving set. But against this it may be said that such distortion would be noticeable only in the case of a very powerful signal. Now owing to its shock effect upon the aerial a strong signal makes very fine

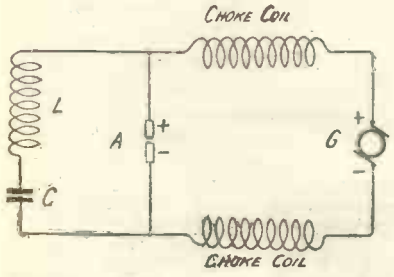


Fig. 5.—The circuit of an arc transmitter.

tuning impossible. You cannot, for example, get rid of a broadcast transmission from a main station at 10 miles range by a hairbreadth movement of your condensers. Hence, tuning is probably automatically made flat enough by the strength of the signals to do away with the distortion which would be caused if part of the modulation were suppressed.

LAMBDA.

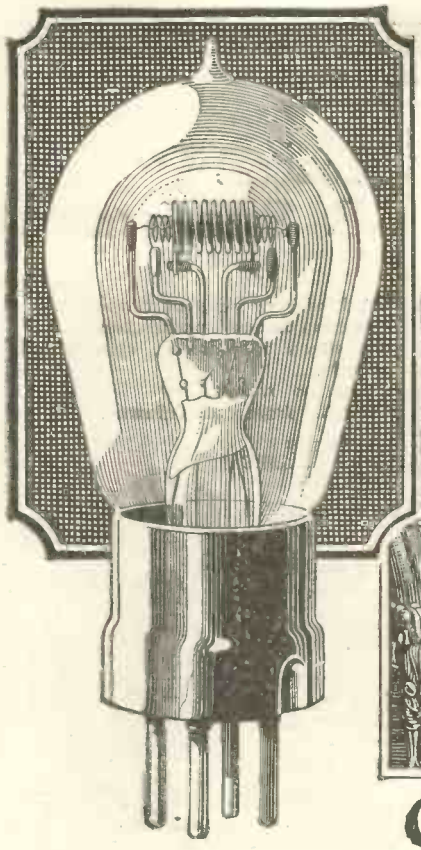
The "Tri-Cell."

To the Editor of MODERN WIRELESS.

SIR,—I have just completed "The Tri-coil Reflex," as explained in September issue of MODERN WIRELESS. The results are really fine. 2LS (8 miles) is decently audible on Amplion Junior, also 2ZY and 5NO, all other B.B.C. stations are received with ease and at good strength on the phones, also many Continental stations were picked up with ease. Hoping this might interest readers contemplating building this set.—Yours truly,

A. WEBSTER.

East Keswick, Leeds.



Louden

Columbus and the egg

Missing the obvious is a fault most of us are guilty of at some time or other, and valve designers have proved no exception.

One of their chief aims has been to eliminate "mush"—that roaring or hissing sound which so often spoils what otherwise would be perfect reproduction. It was found that "mush" was due to objectionable charges of electricity congregating near the anode and interfering with the electron stream.

All sorts of experiments were tried. Some increased the volume but at the expense of purity; others were free from distortion but still had "mush," and so on; and we seemed as far off as ever from our ideal valve, giving ample volume, no distortion and no mush.

Then suddenly came the obvious solution. We simply made a way of escape for these objectionable charges—we made the anode like a spiral and immediately we got silver clear reproduction with plenty of volume.

It has been decided to put the Silver Clear Louden on the market at the extraordinarily low figure of 10s. This represents a certain faith on our part. To justify it the Louden must sell in enormous quantities.

But we cannot pretend to be taking much risk.

Once you have tried the Silver Clear Louden you will be satisfied with no other.

The Plain Louden for Detecting and Low Frequency Amplifying.
Filament ... Volts 4.8–5.
Filament Amps. ... 0.4.
Anode Volts ... 40–80.

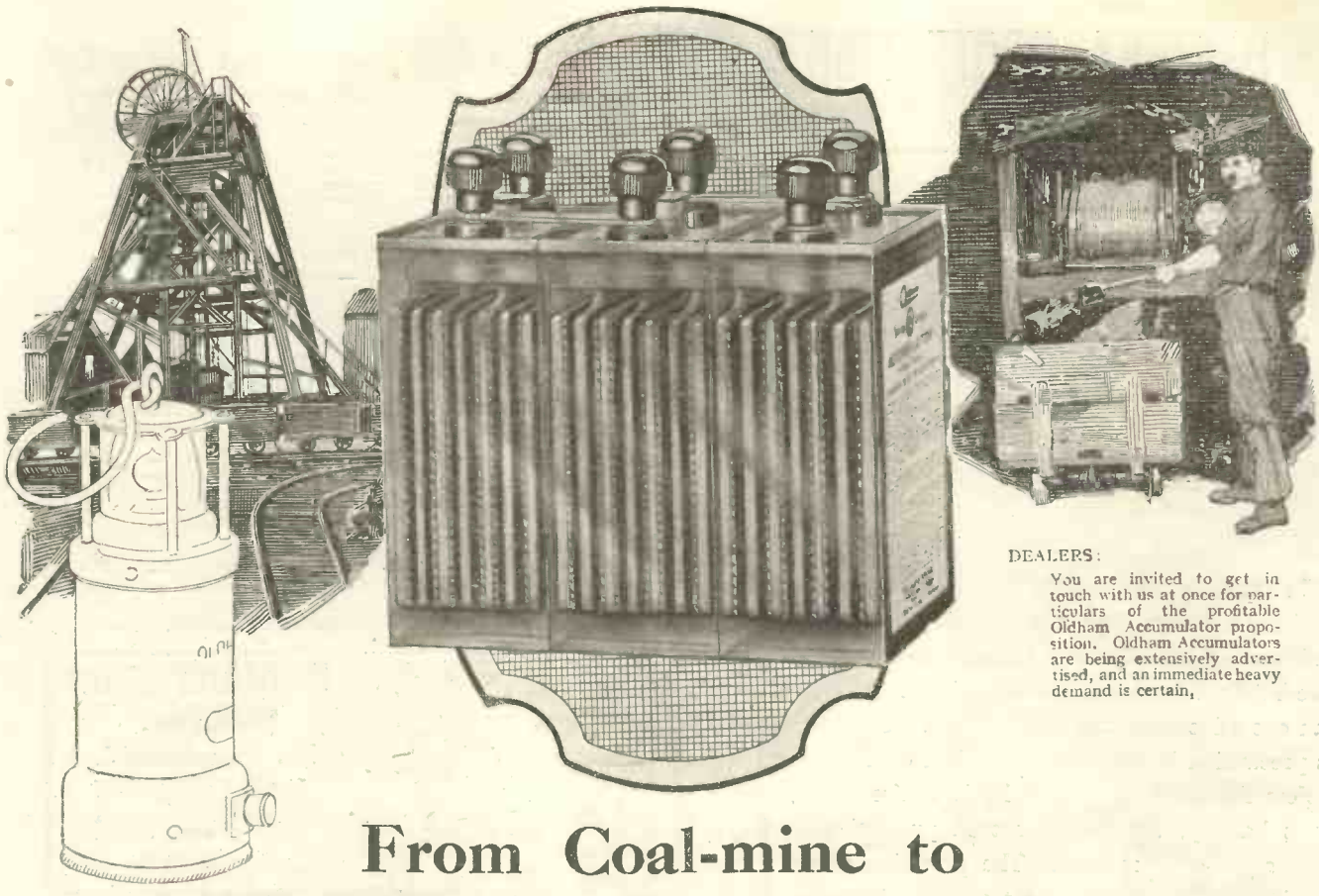
10/-

The Blue Louden for H.F. Amplification.
All Loudens are silver clear and free from mush.
The current consumption is very low and the life long.

Louden Valves - Silver Clear

ADVT. OF THE FELLOWS MAGNETO CO., LTD., PARK ROYAL, LONDON, N.W. 10.

E.P.S.1.



DEALERS:

You are invited to get in touch with us at once for particulars of the profitable Oldham Accumulator proposition. Oldham Accumulators are being extensively advertised, and an immediate heavy demand is certain.

From Coal-mine to Radio Receiver.

IT is difficult to imagine a more arduous test for an accumulator than the gruelling conditions in the interior of a Coal-mine. Long hours of continuous lighting and hard knocks are the inevitable lot of the Miner's Lamp. And yet for the electric lamp to supersede the old Davy Lamp, it must possess long life and be thoroughly dependable under all conditions. Failure would mean not only increased working costs, but would also create a dangerous loss of confidence on the part of the men working below.

To the miner his lamp is as precious as his eyesight. In a crisis its inability to provide light in plenty may mean the difference between life and death.

Small wonder, then that the years spent in bringing the Oldham Miner's Lamp to perfection has resulted in the evolution of an entirely new process for the manufacture of accumulator plates. The magnitude of its success can be gauged by the fact that over 50 per cent. of the electric Miners' Lamps in use to-day are of Oldham manufacture.

This same *special activation process* is now being applied to Accumulators for Wireless use. As every amateur appreciates, he expects from his accumulator a two-fold service; a constant and absolutely unvarying supply of current, and a long life between charges. This work devolves entirely upon the plate; making a better plate means, therefore, a substantial improvement in the accumulator. And Oldham Accumulators—although not previously advertised in these pages—have already obtained a tremendous reputation among wireless experts and critics who are in a position to descriminate. When you purchase your next Accumulator, therefore, it will pay you to see that it is an Oldham—most good Dealers stock them.

In spite of its greatly increased life and superior construction, it costs no more than an ordinary Accumulator.

Oldham & Son, Ltd.—Denton, Manchester.

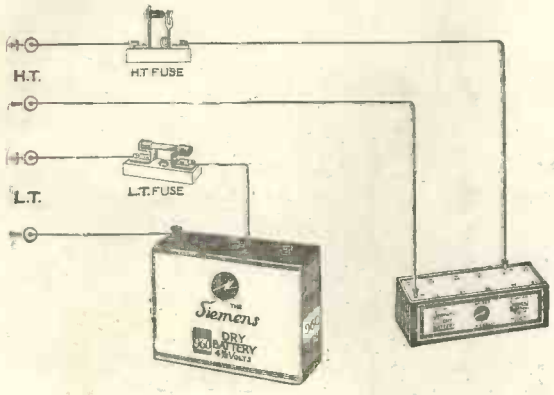
London Office: Great Chapel Street, Oxford Street, W.1.

Special Activation Process

OLDHAM ACCUMULATORS

Gilbert Ad. 1508.

BATTERY PROTECTION



"In commercial installations it is the invariable practice to ensure that any electric battery installed is adequately protected by suitable devices which will immediately break the battery circuit in the event of an excessive discharge taking place. Unfortunately, this precaution is one which is seldom observed by the Wireless Amateur and, until he is confronted with a useless battery, the need for such protective devices is not sufficiently realised. The provision of suitable fuses is quite a simple matter and the initial cost of them comparatively small. On pages 19 and 20 of this Catalogue we illustrate and describe our Fuse Q.2875 for protecting the filament (L.T.) battery and Fuse Q.2890 for protecting the anode (H.T.) battery. When ordering the L.T. Fuse Q.2875 it is desirable to specify the maximum current which the fuse will be called upon to carry safely."

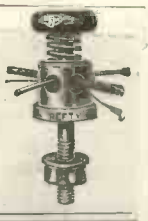
"The fuses are mounted on porcelain bases which may be affixed to any convenient woodwork. The fuses should preferably be inserted in the positive connecting lead from the respective batteries to the receiving set; but in cases where separate tappings are taken from the H.T. battery, the fuse for this battery may be connected in the negative lead."

"A suitable wiring diagram is shown above."

Extract from our Catalogue 595, a copy of which will be sent on application.

Advertisement of Siemens Brothers & Co., Ltd.
Woolwich, S.E. 18.

Terminate Those Terminal Trials, Put in a Refty And be all Smiles.



IMPORTANT NOTICE

re

WATMEL VARIABLE GRID LEAK

(*Patent No.* 206098).

The Watmel Wireless Co. wish to notify the trade and public that their Variable Grid Leak Patent Application No. 206098 *was contested in the Comptroller's Court, and on Appeal; in both instances the Patent Grant was upheld and costs awarded.*

It is only fair to bring these facts to the notice of persons and firms purchasing or dealing in Variable Grid Leaks, otherwise the successful issue achieved might not be known, and the public and trade might be persuaded that no Patent is involved in the Watmel Variable Grid Leak.

It is the aim of this Company to protect traders', customers' and also its own interests by securing Patent protection for the novelties in its specialities, as it is these novelties, invented by experts and exhaustively tested, which are the Hall Mark of all Watmel Products.

All goods of our manufacture bear our Reg. Trade Mark **WatMel**

Watmel Grid Leaks & Resistances are the best for the following reasons.

Constantly variable.
Silent in operation.
Constant in any temperature.
Dust and damp proof.
Each tested and guaranteed.
Neat and well made.

5 to .5 Megohms **2/6** 50,000 to 100,000 Ohms **3/6**

Other Resistances to suit any circuit.

Send P.C. for Descriptive Folder.

SEE THE TRADE MARK ON EVERY GRID LEAK. **WatMel** BEWARE OF IMITATIONS.

Coil Former for Winding Inductance Coils **4/6**

For full details see "Apparatus Tested," June 18th. "Wireless Weekly."

Insist upon "WATMEL" at your Dealers.

NOTE OUR NEW ADDRESS:

WATMEL WIRELESS CO.

332a, Goswell Road, London E.C.1.

'Phone: CLERKENWELL 7990.

The guinea Crystal Set

The "Sparta"

YOUR opportunity to get the latest and best Crystal Receiver—a high-quality instrument which embodies features that wireless men recognise as essential for really successful reception. This is one of the well-known "Sparta" products, backed by the Fuller guarantee. You can rely on it.

Price 21/-

Ask your Dealer or write to us.

FULLER'S UNITED ELECTRIC WORKS LTD., Woodland Works,

Chadwell Heath, Essex.

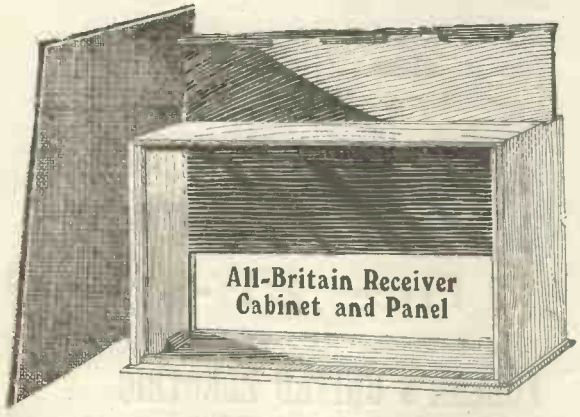
Telephone: Ilford 1200 (6 *lines*). *Telegrams: "Fuller, Chadwell Heath." London Depot:* 58, *High Street, W.C.2. Telephone: Gerrard* 5070.

Ask for the "Sparta" Set

Pilot Panel Service

WHEN a man decides to build a good Receiving Set he immediately comes up against the difficulty of a suitable cabinet and the drilling and engraving of the Panel. Cabinet making is a skilled man's job and many a perfectly good piece of ebonite has been spoilt by a hole in the wrong position or because it has been incorrectly cut to size.

To eliminate most of the difficulties in Set-building we have instituted the "Pilot" Panel Service. In future all Sets described in *Modern Wireless* or *Wireless Weekly* will be available in sets of parts for the Home Constructor with panels ready drilled, tapped and engraved. Two types will be placed on the market—Type A following the author's literal specification and using his actual components and Type B, an adaptation using Peto-Scott guaranteed components. Naturally, through standardisation of components and our lower manufacturing costs due to large output, Type B will show a large saving over Type A.



Other Receivers available under the "Pilot" Panel Service

In addition to the two Sets described in this Advertisement, we also supply the following Modern Wireless Receivers in Type A and Type B for home construction. Finished instruments in either type are also available.

The Puriflex Receiver.
The All Concert de-Luxe Receiver.
The 3-Valve Dual Receiver
The Transatlantic V (and others).

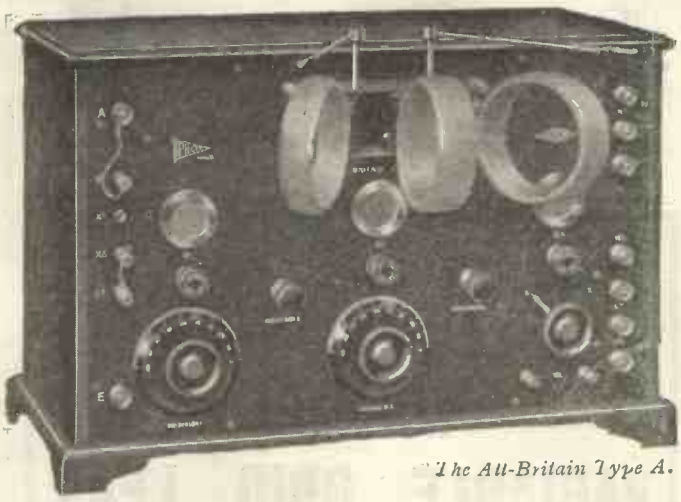
Our Guarantee

Remember that if our instructions are followed we positively guarantee that all Type B Receivers are the equal in every respect to the more expensive Type A sets. Our Service Dept. is available for all our customers and will test and rectify errors of construction at a nominal charge. We want all our customers to have the utmost confidence in every Set produced under the "Pilot" Panel Service.

PETO-SCOTT Co., Ltd.

Registered Office & Mail Orders: 77, CITY ROAD, E.C.

Branches: LONDON—62, High Holborn, W.C.1. PLYMOUTH—4, Bank of England Place. LIVERPOOL—4, Manchester Street. CARDIFF—94, Queen Street. WALTHAMSTOW—230, Wood Street.



The All-Britain Type A.

The All-Britain Receiver

("Modern Wireless," Sept. Issue).

The new All-Britain Receiver in the September issue of "Modern Wireless" is proving one of the most popular Sets of the season. A 3-valve Set, it has much to recommend it on account of its simplicity and ease of operation. By including it in our "PILOT" Panel Service experimenters are able to build it up at a big reduction in cost. It should be noted that the author's design of the All-Britain Receiver is so similar to our own standard Type B Receivers that the Cabinets for both types are identical. The fundamental difference is that in Type A the Valves project outside the panel in a horizontal position while in Type B they are totally enclosed at rear of panel entirely out of harm's way. Therefore, in the list of prices it will be seen that Pilot Cabinet B is fitted with an additional baseboard to screw on to the ebonite panel to carry all the components.

PRICES :

Type A.—Ebonite Panel, guaranteed Post Office quality, of highest grade, 10 in. by 16¼ in., drilled, tapped and fully engraved **16/-**

Polished Oak Cabinet, with sliding back, to take above panel **15/6**

Complete kit of components, exactly as author's specification, but with Max-Amp Transformer and Peto-Scott all-ebonite improved Coil Holder **£4 12 0**

Type B.—Ebonite Panel, guaranteed Post Office Ebonite of highest grade, drilled and tapped to take Peto-Scott guaranteed components, size 10 in. by 16¼ in., matt finished by hand **10/-**

Engraving extra **3/-**

Polished Oak Cabinet, with sliding back, but fitted in addition with panel baseboard **17/-**

Complete kit of guaranteed Peto-Scott Components. In this kit we include Polar Condensers and Lissenstats, but otherwise everything else is of our own manufacture and fully guaranteed in every respect **£4 2 6**

The Family 4-Valve Set

(Radio Press Envelope No. 2).

Exactly as Author's specification, except that an ebonite panel is used instead of one made of wood. This permits components being mounted flush on the panel and greatly improves the appearance of the whole Set. Valve-Holders are of the same anti-capacity type, but of our own manufacture. Two Max-Amp Transformers are supplied instead of one Max-Amp and one Igranic, and an Igranic Potentiometer is substituted for the T.C.B.

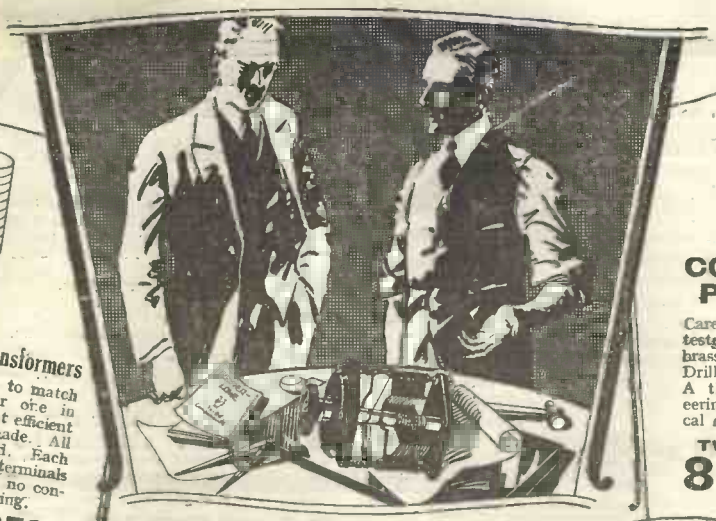
Complete kit of Components, only as above amended specification, **£6 1 0**

Ebonite Panel, 24 in. by 8 in. by ¼ in., drilled, matt finished, and fully engraved **£1 2 6**

Panel only (undrilled and not engraved) **12 6**

Polished Oak Cabinet, 24 in. by 8 in. by 4 in. **£1 5 0**

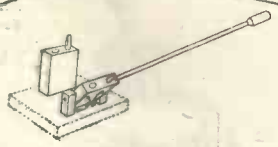
Gilbert Ad. 1114.



Plug-in H.F. Transformers

Each one guaranteed to match perfectly every other one in same series. The most efficient H.F. Transformers made. All ranges can be supplied. Each transformer has its four terminals clearly marked so that no confusion can arise in wiring.

ALL RANGES 7/- EACH



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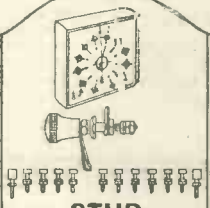

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